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The International Journal of Orthodontia and Oral Surgery

A Monthly Journal Devoted to the Advancement of the Sciences of Orthodontia, Oral Surgery, and Dental and Oral Radiography

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Editor-in-Chief

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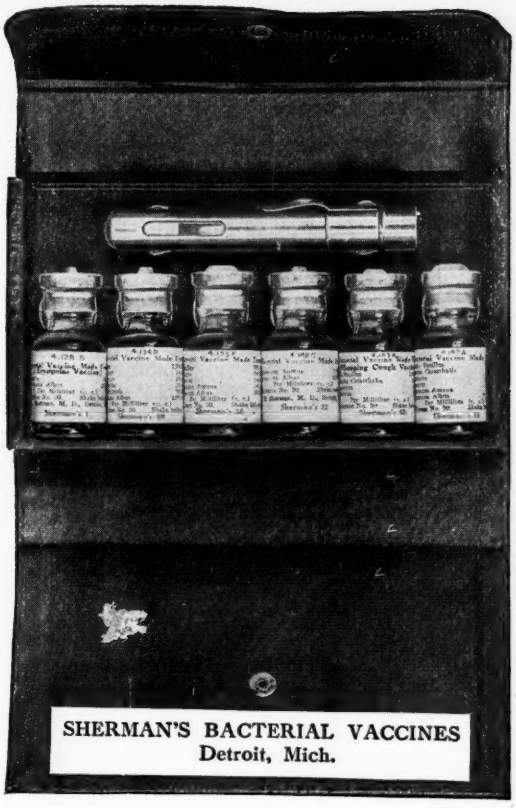

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VOL. VI ST. LOUIS, DECEMBER, 1920 NO. 12

ORIGINAL ARTICLES

THE REMOVABLE LINGUAL ARCH AND ITS RELATION TO THE ORTHODONTIC PROBLEM*

BY J. V. MERSHON, D.D.S., PHILADELPHIA, PA.

IN general the normal development of any part is dependent upon its proper nutrition, and this is dependent upon the functional activity of this and other related parts." (Conklin, "Heredity and Environment.")

Until recently orthodontia has been studied as a tooth problem, taking into account the size and shapes of the teeth together with arch form and cusp relationship, and the theory has been evolved that teeth moved from malocclusion to normal occlusion and with proper relationship of the cusps and inclined planes established, the mechanical relationship, by virtue of the mechanical locking of the cusps and inclined planes, will cause these teeth to remain in position of normal occlusion.

From this theory one would be led to believe that cusp relation is a primary force and a controlling one. This would be true if the teeth were implanted in a piece of metal which is fixed so that no change could take place in the supporting structure or if the teeth in the opposing jaws were held rigidly in occlusal contact by well-developed muscles. But the bone supporting the teeth is plastic in nature, subject to many influences and constantly changing, and the muscles which hold the teeth in occlusion are not rigid, but to the contrary in most of our patients are very flabby and relaxed. Too frequently this theory fails and the teeth drift to their former positions. So frequently indeed is this true that the orthodontist is continually groping for a remedy for his failure, and he has gone but little farther than the field of orthodontic appliances. While there is no doubt that some appliances are more efficient than others

*Read before the Pacific Coast Society of Orthodontists, San Francisco, February 17, 1920.

and some men are better technicians than others, it is my belief that the solution of our problem will never be found simply by the use of orthodontic appliances.

We must approach the problem from an entirely different angle. Primarily, the orthodontic problem is not a tooth problem and, consequently, is not primarily a problem of occlusion, but it must be studied from the standpoint of development and its relation to the functional forces.

"One of the greatest and most far-reaching themes which has ever occupied the minds of men is the problem of development." (Conklin.) It is well known in biology that all form depends on function and our problem is essentially a study of form. The human body is composed of certain well-known tissues, and very early in our life's history these tissues through certain functional changes are formed into organs, and it is through the function of these tissues and organs that we have the developing human body. Most of the organs and tissues of the body are developed under their own function.

There is a definite functional relationship between organs and tissues, so is there a functional relationship between the different organs. If one organ of the body should partially fail in its function, it would have a retarding influence on other organs associated with it; so with this interdependence of organs we have the body as a whole developed perfectly or imperfectly according to organ function. "The human body is an exceedingly complex structure. Many organs must originate, grow, develop, and be co-ordinated and adjusted in one body. We often forget or underestimate the importance of growth. If an organ is undersized it is a source of weakness in the body. This is evident of heart and lungs, but equally true of all organs. Bone and muscle must grow well in the child before they can be developed and hardened by the boy and girl." (Tyler, "Growth and Education," page 55.)

In our study of the oral cavity as an organ, we must study it in its relation to the other organs of the body. It is affected in its growth and develops just in proportion as we have normal or abnormal function of the associated organs. The teeth are peculiar in that they lack the power of repair and are fully formed before they begin to perform the function for which they were designed. It is not until they are fully formed and erupted into occlusal contact, that they become an active functional factor in general development. Through the interrelationship with the muscles of mastication and the supporting bones the development of the tooth in its bony crypt is a normal function, and a factor in bone development prior to and during its eruption in so far as it is part of nature's original plan. The negation of this is evident in the lack of development seen when teeth are congenitally missing. The tooth on erupting has no power of directing itself into normal occlusion; it can only occupy such position in the dental arch as the associated tissues together with the developing bone in which it is located place it. The mal position of a tooth may be largely established before the tooth starts to erupt. So for these reasons I claim that primarily the orthodontic problem is not a tooth problem, but that malocclusion is undoubedly the result of a functional disturbance in bone development together with its associated tissues.

The teeth depend on the osseous tissues for their support and to hold them in occlusion whether in normal occlusion or malocclusion. Tooth occlusion is

secondary or a symptom indicating only to a degree the variations in the development of the bones of the mandible and maxillæ. Our problem is a much larger one than simply moving teeth into normal occlusion with an orthodontic appliance, and we will have to look for help in many of our cases in some other field of medical science.

Is it possible to correct all cases of malocclusion? Can we correct all cases and retain the teeth so that they will not relapse? Is it reasonable to assume that in a case of faulty development of both mandible and maxillæ in a child with very narrow arches and teeth badly crowded, with flabby muscles, anemic, generally poorly developed and underweight, we can restore with orthodontic appliances such a mouth to 100 per cent perfect and retain it with the rest of the child only 80 per cent normal in its development? In spite of the fact that we cannot do so, we are still using orthodontic appliances and will continue to use them.

While orthodontic appliances will continue to be indispensable, so long as in the nature of the circumstances we are compelled to correct malocclusion by mechanical means, a proper comprehension and appreciation of the underlying principles of development involving the relationships of function to form must necessitate the use of orthodontic appliances so constructed and adapted that they shall become auxiliary to and co-operate with the developmental forces involved in the orthodontic procedure and not obstruct or hinder their normal action.

In the selection of an appliance to produce bone development and tooth movement, we must remember there is an interrelationship of function between the teeth and the peridental membrane, the bones supporting them, the muscles of the oral cavity, the nervous system and the circulation. The appliance to produce the proper stimulus to the tissues supporting the teeth to be moved, must do it in such a way that this interrelationship of function will not be disturbed. Each tooth is a unit and a law unto itself, having motion by virtue of the peridental membrane, which becomes operative in mastication, and through the action of the lips, cheek and tongue. This motion in turn reacts on the bone and its supporting tissues. If this motion is denied the tooth by a rigidly attached appliance, the supporting bone degenerates because the bone and tooth are robbed of their function; or when an appliance with which the tooth is being moved is so rigidly attached to the tooth that the movement is a positive one and the tooth is entirely under the control of the appliance, it destroys the functional relationship between the tooth and the rest of the tissues, and when the appliance is removed the tooth function is so disturbed that the tooth will not remain in its new position. By virtue of this functional interference, an unbalanced functional force is established which is very difficult to overcome, and we have difficulty in retaining the tooth in the position to which we have moved it. In selecting an appliance, the first requisite is that it must not interfere with the function of the teeth or any of the associated tissues or organs of the oral cavity.

As our problem is a developmental one due to functional disturbance, before we attempt to direct development in the dental arches of growing children, we must know the direction in which the development is taking place. In our efforts to produce growth by pressure artificially applied to the teeth with a me-

chanical appliance, so that by bone development these teeth may be carried to their correct positions according to our standards of occlusion, the amount of pressure to apply is rather difficult to determine. Of course the ideal would be that amount which corresponds with the normal growth force in developing bone, but this we have no means of measuring; so the smallest amount of pressure we can apply and control, which will cause bone development and cause the tooth to change its position, would approximate the normal force of development as closely as it is humanly possible to estimate it.

Since development in the dental arches is a general enlargement forward and outward and occlusally, this would indicate that if we place an appliance on the lingual surfaces of the teeth we at least would not interfere with development, as the normal direction of growth would be away from an appliance so placed. When we apply gentle pressure to a tooth sufficient to stimulate bone growth and tooth movement, after the tooth has moved beyond the influence of the appliance, growth does not suddenly stop but continues for a long time as the result of the stimulus received from the appliance. It can be readily seen therefore that an appliance rigidly attached to the buccal and labial surfaces of the teeth would have a retarding influence on this continued growth and tooth movement.

DEVELOPMENT OF THE REMOVABLE LINGUAL ARCH

With these thoughts in mind, I wish to present for your consideration the removable lingual arch, which closely approaches the ideal appliance in accordance with our modern conception of tooth movement in form development. The removable lingual arch is an arch wire of suitable size adapted to the lingual surfaces of the teeth. It is attached by means of a lock to metal bands cemented on the anchor teeth, usually the first molars, through which with its various auxiliary spring attachments stimulation is applied to the teeth causing developmental changes and tooth movement.

With me the lingual arch used removably has been and still is in the evolutionary process. I first used it in January, 1909. At that time it was used with round horizontal tubes soldered on the lingual surfaces of the molar bands with the distal end of the tube closed, and I am at times still using them. With this style of tube it was very difficult to remove and replace the arch wire. To overcome the difficulty, a round vertical tube was used locking the arch wire in the same manner as it is done today. The tendency with the tube thus used was to rotate the molar teeth even though the arch wire was extended well back on the molar band. When Drs. Angle and Young brought out the Young-Angle lock, using an elliptical vertical tube on the molar band, that helped to solve the problem, but the post would move in the tube and again it would cause the molars to rotate slightly. To overcome this I developed the half-round tube, which I used first in June, 1915, and have been using it on molar bands for the purpose of attaching the lingual arch ever since.

DESCRIPTION OF THE LINGUAL ARCH

The arch consists of one large main wire, a lock, of which the main wire is a part, and auxiliary springs. The lock (Fig. 1) is composed of the half-round

tube soldered to the molar band in a vertical position, a post which accurately fits the half-round tube soldered to the main arch wire, and a smaller wire, soldered to the main arch wire, passing under the half-round tube, locking the arch in place; this latter we call the lock wire.

The materials used in the construction of the main arch, the auxiliary springs, and the lock, the half-round tubes and posts are all alloys of gold and platinum, which possess great spring, that is retained over a long period of time under stress, and can be readily softened and retempered again. Several of the manufacturers have produced alloys possessing these qualities.

In selecting the material and the sizes of wire, use the smallest possible variety of material and standardized sizes. For the main arch wire 36/1000ths or No. 19 gage B. & S. after long experience has been adopted; for the lock wire 26/1000ths is the best size; for the auxiliary springs after many tests 22/1000ths has proved without doubt the proper size. The half-round tubes I have used in many different lengths, but have at last decided on one size exclusive of all others, namely, 8/100ths of an inch. The half-round wire, which comes in six-

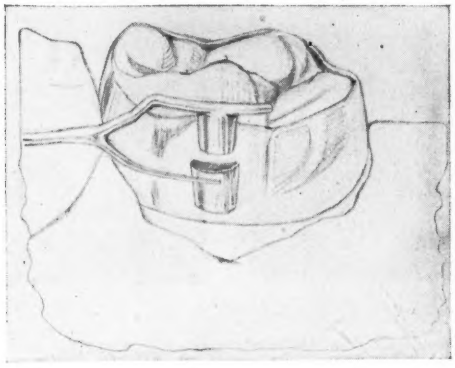


Fig. 1.

inch or foot lengths, should of course always fit the tubes accurately. If it does not fit accurately do not use it, as it will cause trouble later on.

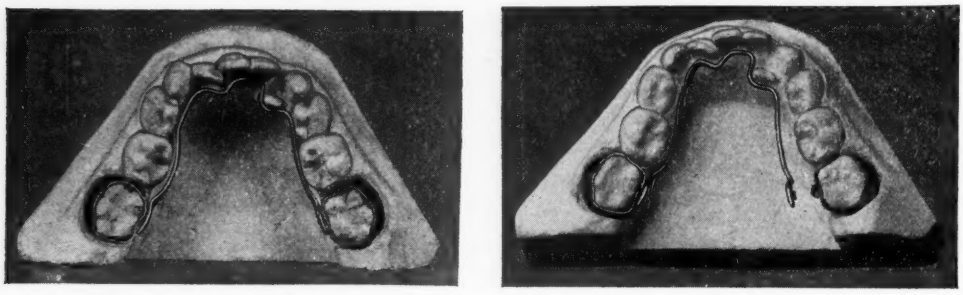
CONSTRUCTION OF THE ARCH

The arch is constructed on a plaster model with molar bands which have been fitted to the natural teeth, with half-round tubes soldered to their lingual surfaces and transferred to the corresponding teeth on the plaster model. The main arch wire is then bent to conform to all the inequalities in the dental arch produced by the irregularities of the teeth, and should extend distally beyond the half-round tubes one-eighth of an inch. Slightly mesial to the tube we make a slight step in the wire by bending it first toward the gingiva, then again parallel with the gingiva. Place the arch wire very carefully in its correct position on the model and with a sharp instrument mark the arch wire opposite the tubes, then proceed to solder, free hand, the half-round post wire to the main arch wire opposite the marks, cutting it off the proper length for the half-round tubes. We now place one of the posts in the tubes. Should it not lie correctly on the model, remove the arch, and with two pairs of Dr. Young's pliers by grasping the wire on opposite sides it can be twisted to its desired posi-

tion. Proceed with the opposite side in the same manner. Replace the arch with both sides in the tubes. Should any part of the arch stand off from the model, it can readily be brought to place by heating this spot to a cherry red and while hot pressing it home with a suitable instrument and holding it there until it sets. The arch is again removed from the model and the lock wire is soldered to the main arch wire, just mesial to the post and bent to pass gingivally to the tube where it is cut off. The arch is now ready to be placed in the mouth.

PLACING THE ARCH

Remove the anchor bands from the model and cement them on the teeth. In trying the arch in the mouth, grasp the arch on the left side in the region of the half-round post with a pair of How pliers, and place the post in the tube on the left side. The arch should lie in its proper position, with the half-round post on the opposite side parallel with the half-round tube (Fig. 2-*A*). Should it not, twist or bend the arch until it lies correctly. Remove the post from the tube on the left, then place the right side post in the tube. If the post on



A. *B.*

Fig. 2.—*A*, Showing correct position of lingual arch; *B*, showing incorrect angle of the post.

the left side drops into place with the tube, then the arch is ready to be locked in place.

LOCATION OF HALF-ROUND TUBES

The tubes should be placed on the lingual surfaces of the anchor bands, usually in the center of the band mesio-distally in both upper and lower jaws. In the lower jaw they should be placed as near the occlusal edge of the band as possible, allowing only sufficient distance between the occlusal edge of the band and the top of the tube for the arch. The tubes are so placed for the reason that the post is easier to place in the tube; if it is too far toward the gingiva, it is difficult to see the tube in the lower jaw on account of the tongue and saliva. In the upper jaw the tube should occupy the same position mesio-distally, but should be placed as near the gingiva as possible, otherwise the lingual cusps of the lower molars will come in contact with the arch and the continuous biting on it will eventually cause the arch to break.

PROPER LOCATION OF THE ARCH

The arch should occupy a position on the lingual surface of the teeth as close to the gingiva as possible. The arch when first placed in the mouth should be passive, the patient being allowed to wear it long enough to become entirely

accustomed to it, usually a week. During this period children are more likely to play with the arch with the tongue and fingers than thereafter. Therefore very strict caution should be given both patient and parent regarding this evil, as well as against eating sticky candy. After these precautions I seldom have trouble, but should I have, at the next visit I wire the arch with a fine ligature wire to some favorable tooth, and this usually cures the trouble after the patient becomes accustomed to the arch.

USE OF THE ARCH

The force necessary to produce tooth movement with the lingual arch is obtained in three ways: first, by straightening out the inequalities in the arch

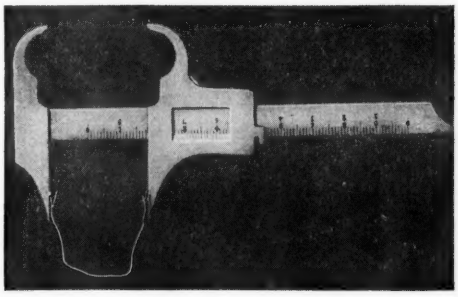


Fig. 3.

wire; second, by auxiliary springs soldered to the main arch; and third, by stretching the wire by means of the wire-stretching pliers.

At the next visit after placing the arch in the mouth, which is usually the next week, the arch is removed from the mouth. This is accomplished by tak-

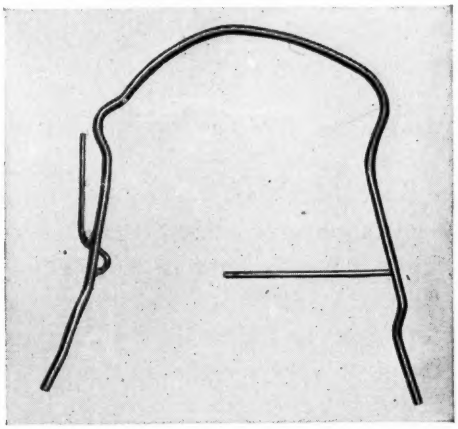


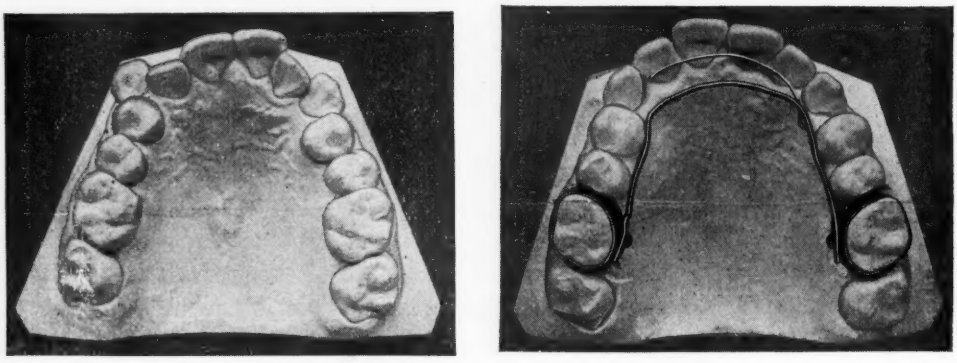
Fig. 4.

ing a suitable instrument and bending the lock wires from under the tubes on both sides, and the posts teased out of the tubes. With a pair of calipers, such as shown in Fig. 3, measure the distance from one half-round post to the one on the opposite side. This is absolutely necessary, especially if we intend to make a change in the main arch before replacing the arch, being sure to remeasure to see that the distance from one post to the other is the same as when removed.

At times it is wise to take a measurement in the region of the first bicuspids as well. If you are treating the case by taking the inequalities out of the main arch, which were made to fit around malposed teeth, a pair of flat-nosed pliers are best adapted for this work. In taking out a curve that fits around a tooth make but little change each time, remembering that you are only stimulating growth, not pushing the tooth. In removing a curve from the arch it not only causes the arch to bear a little harder on that particular tooth, but it slightly enlarges the whole circle of the arch.

THE AUXILIARY SPRING

The auxiliary spring is a small wire soldered to the main arch wire for the purpose of applying a gentle pressure to a tooth. The spring (Fig. 4) is usually soldered to the gingival side of the arch, and at right angles to the main arch, using 14-k. solder, then bent in the direction in which we wish to apply force. The reason for soldering the spring at right angles to the arch and bending it is that, in soldering, the high heat, especially with a high karat solder, removes



A. *B.*

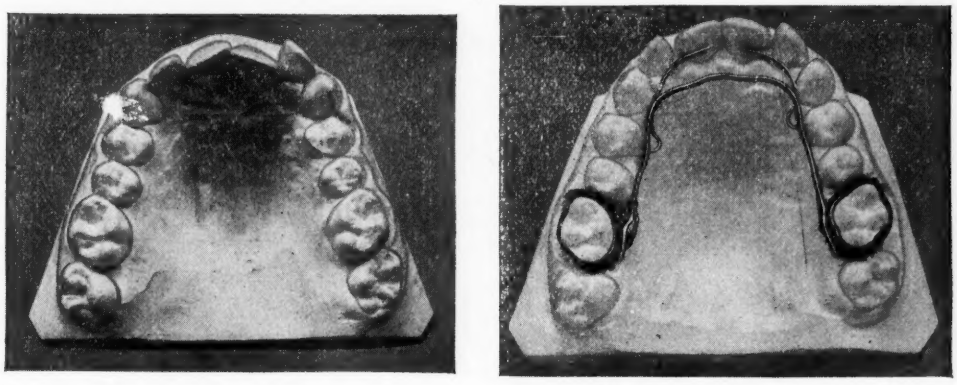
Fig. 5.—Showing the case before (*A*) and after (*B*) the use of the spring.

the temper from the wire, while the bending to correct position restores the spring temper.

The longer I use the lingual arch, the more I find myself using the auxiliary springs for development and tooth movement, using the main arch to follow up and bring about the general conformation of the dental arch. The auxiliary spring made of springy wire, 22/1000ths, properly attached to the main arch as a method of applying a stimulus to the teeth for the purpose of producing development and tooth movement very closely approaches the normal functional forces of development, and it has been my experience that teeth properly moved by use of the auxiliary spring have not the tendency to return to their former positions.

The most of our work in orthodontia consists in the treatment of underdeveloped or mal-developed dental arches, and we have two well-known conditions to deal with in many of our Class I cases: one in which the lateral teeth are almost in contact with the first bicuspids on one or both sides, leaving the cuspid teeth labially placed and very conspicuous; and second, a type where the arches are very narrow, requiring development in the bicuspid and cuspid re-

gions. For both of these types the auxiliary spring is most efficient. The forward development of the anterior teeth we accomplish in two ways: first, by attaching a spring to the gingival side of the main arch opposite the first bicuspid teeth at right angles to the main arch (Fig. 5-*B*), then bending the spring forward in a very short bend forming a small loop, and curving it around to correspond to the anterior curve in the main arch, allowing it to extend so that



A. *B.*

Fig. 6.—Showing the case before (*A*) and after (*B*) the use of the springs.

it will engage the lateral tooth on the opposite side. Another method is to use two springs attached to the main arch, one on each side opposite the bicuspid teeth, bending them forward to engage the lateral and central incisors on their respective sides (Fig. 6-*B*).

To produce lateral development in the bicuspid and cuspid region, we attach the spring to the main arch wire opposite the space between the first and second

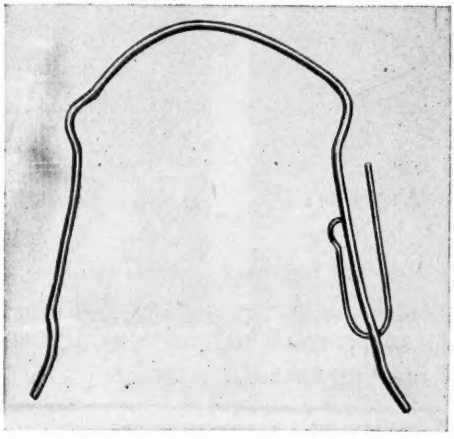
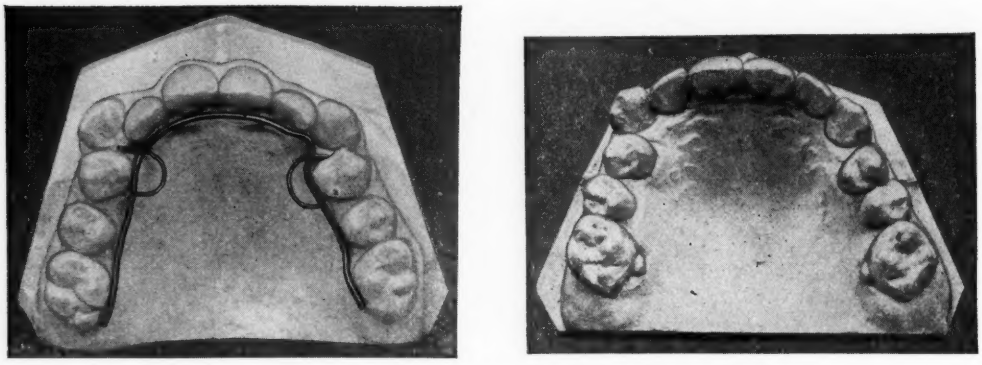


Fig. 7.

bicuspids, bend the wire distally, parallel with the main arch wire, almost to the first molar, then make a short loop bending it again toward the cuspid tooth and leaving it as long as required according to number of teeth to be moved. This gives us a compound loop in which the pressure is the same on all the teeth (Fig. 7).

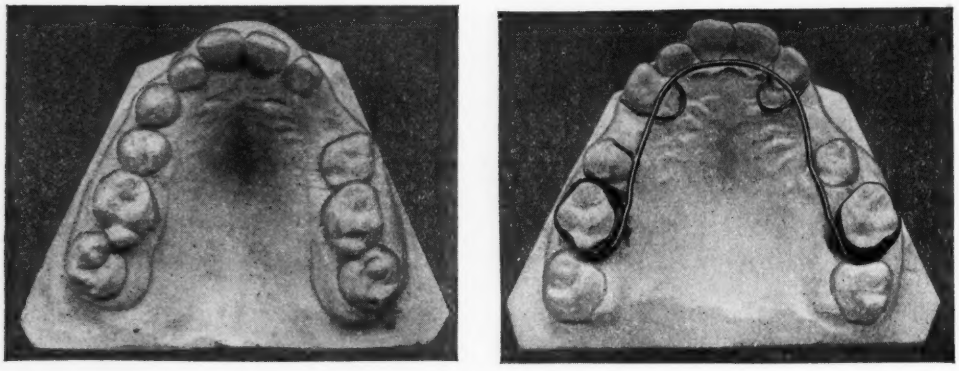
ROTATING TEETH

The auxiliary spring is most efficient for rotating teeth. To produce rotation without banding the tooth, let us take as an example the upper first bicuspid, which frequently erupts with the lingual cusp rotated mesially (Fig. 8). This is very easily corrected by soldering a spring to the main arch, opposite the approximal space between the first and second bicuspids. Bend the wire mesially, forming a half circle with the free end of the spring wire engaging the first bicuspid and applying pressure on the mesial surface opposite the lingual cusp. The same



A. *B.*

Fig. 8.—*A*, With springs in position; *B*, showing result of the use of the springs.



A. *B.*

Fig. 9.—Showing the case before (*A*) and after (*B*) the springs were in position and the result.

principle of attachment can be employed for moving teeth mesially or distally, also for the purpose of opening spaces.

TO OPEN SPACES FOR IMPACTED OR MISSING TEETH

This is accomplished by the use of two auxiliary springs soldered to the arch, one the width of a tooth distal to the place we wish the space, attaching the springs the width of two teeth apart. The one most distal curves mesially to engage the tooth distal to the space (Fig. 9-*B*). With the loose end of the spring flattened by disking the sides, this end usually passes to the gingival side of the arch to engage the teeth.

To move the anterior teeth mesially or distally, solder a spring to the arch about fifteen one-hundredths of an inch distal to the tooth to be moved (Fig. 10). Bend the spring in a curve, passing the loose end, which should always be flattened by disking both sides until it is very thin, to the gingival side of the arch, and if properly adjusted (this is most imporant in all of the auxiliary springs) it will pass between the tooth and the soft tissues at the gingival space in the same manner as a thin band. Tooth movement is very easily accomplished if slight pressure is applied to the tooth by tightening the spring from time to time.

One of the most successful methods for rotating teeth is to band the tooth to be rotated in the usual way, with a spur attached to the labial side of the band (Fig. 11-*A*). With a spring wire soldered to the arch some distance from the

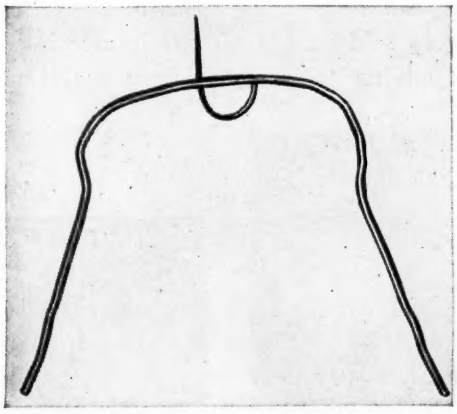
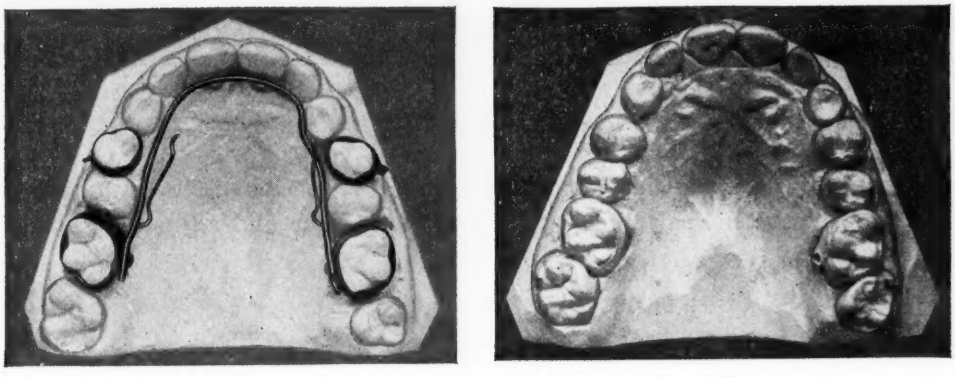


Fig. 10.



A. *B.*

Fig. 11.—Showing the case (*A*) with springs in position, and (*B*) the final result.

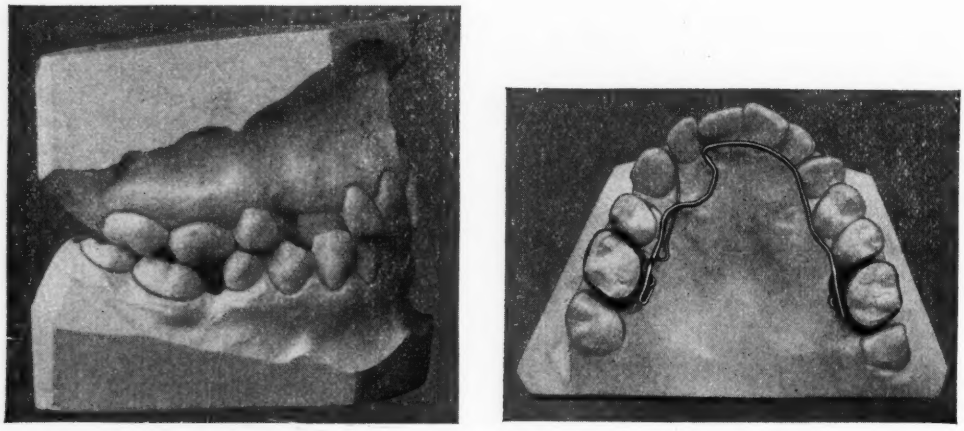
tooth to be rotated, bend the spring almost parallel with the main arch. On the loose end, which should now stand some distance from the arch, place a fine ligature wire, which, passing through the gingival space, engages the spur on the band. After this the ligature wire should be tightened until the spring is in contact with the main arch. It is well to make a hook at the end of the spring wire so that the ligature will not slip off. The tendency of the spring wire to return to its original position will cause the tooth to turn on its axis.

AUXILIARY SPRINGS

I have only mentioned a few ways in which the auxiliary springs may be employed; however, there is no limit to their use and the variety of methods of employing them. The auxiliary spring wire should always be as long as we can control it, as the pressure is more gentle, and it will be surprising to see what a slight stimulation is required to produce bone change (Fig. 12). At times the auxiliary spring may cause the main arch to be pushed occlusally. In such a case the main arch wire should be stabilized by ligating it to a tooth favorably placed.

ANCHORAGE

A word of warning regarding the anchor teeth. There may be times when it will be necessary to band an anterior tooth or in some other way to stabilize the anchor teeth, but very seldom. If we are interfering with our anchor teeth, it is evident we are applying too much pressure and undertaking to produce



A. *B.*

Fig. 12.—*A*, Showing inlocked cuspid; patient twenty-five years of age. *B*, Tooth brought out with spring.

tooth change faster than development will take place. Almost every one in beginning to use the lingual arch applies too much force and adjust the arch entirely too often.

FREQUENCY OF ADJUSTMENTS

Adjustments in the lingual arch, unless for some special condition or reason, should not be more frequent than one every four to eight weeks. We are treating growing children in whom nature through some functional disturbance has failed to develop the dental arches according to our conception of normal form. In a child we should not undertake to stimulate development and tooth movement faster than normal growth would take place in a healthy growing child; otherwise, we will undoubtedly destroy the harmony of function between the tooth and its supporting bone, and establish an unbalanced functional force which is very difficult to correct; and we wonder why our cases relapse. Growth continues long after the appliance has spent its force and the teeth will continue to move for a considerable time as the result of this stimulation transmitted

through the teeth to the bone cells with the appliance, the teeth frequently moving entirely free from the appliance. This is what I would call a normal harmonious functional development.

"A general characteristic of protoplasm is the capacity of storing up or registering the affects of previous stimuli. A single stimulus may produce changes in an organism which persist for a longer or shorter time, and if a second stimulus occurs while the effect of a previous stimulus still persists, the response to the second stimulus may be very different from that to the first." (Conklin.)

If we would only remember that teeth move through a process of growth, that the appliance does not push the tooth, and that there is always an effort on the part of nature to move the tooth into its correct location! Place an appliance on the teeth of a skull and apply pressure; the teeth will not move. Why? Because there is no growth taking place.

Growth is the result of life. We cannot handle the orthodontic problem entirely to our own liking and make development adapt itself to whatever appliance we see fit to use, but we must adapt our appliance to the laws governing growth and development. There are certain laws governing growth. Function is the result of the active force in growth, development is growth plus function, and form is the result of growth plus function, plus development.

With our appliance we do not manufacture growth; we only stimulate an already living, growing, human being. In the past there has been entirely too much tinkering done with the dental arches. I have many patients wearing lingual arches during the vacation season whom I do not see for three months, and when they return the development in the dental arches is so great that the appliance is very loose in the mouth and not in contact with the teeth at all. In the average case that I treat, taking the whole period of time they are under my care, I leave the appliances off almost as much as the child wears them, allowing the whole dental machine to develop under its own function and not by artificial stimulation.

RETENTION

When teeth have been moved from malocclusion to normal occlusion and the proper cusp relationship established the mechanical locking of the cusps of the teeth is supposed to retain them in this position, but on removing our retaining appliance those teeth frequently return to their former position. If mechanical locking by means of this cusp relationship is such an important factor, why do these teeth relapse? The teeth themselves have no power by which they can retrace their steps. Our deduction then would be that we have a force operating in the tissues supporting the teeth which causes them to relapse to their former position, and that these forces supporting and surrounding the teeth, if I may so call them, are greater forces than the mechanical locking of the cusps. I do not mean to discount the value of cusp relationship, for it is absolutely necessary, but I do mean to say that it is not the controlling factor in retaining a denture in normal occlusion where the teeth have been moved from malposed positions. All forces are important and essential but we must have a harmony established between all the forces which operate or functionate. So in moving teeth with an appliance we must use the utmost care to see that the functional

relationship between the tooth and the bone supporting it with its associated tissues has not been disturbed.

CONCLUSIONS

Our problem is one of development; it is a study of growth and the functional forces of growth which control development; the teeth and their occlusion are an incident thereto. We are treating impaired function which results in defective development and we are erroneously endeavoring to do it artificially with a mechanical appliance.

In recommending the removable lingual arch for this purpose, it is not to be considered a universal appliance, and is at times used in connection with the labial arch, especially in Class II and Class III cases. The making and using of the lingual arch are most difficult, but it is a most efficient appliance if properly used. With the lingual arch and the auxiliary springs we can apply a pressure to a tooth which approaches the normal growth force as closely as it is humanly possible to judge, so that we can produce development and tooth movement without destroying the harmony of function between the tooth and its supporting tissues.

DISCUSSION

Dr. Robert Dunn, San Francisco, Cal.—In this discussion of Dr. Mershon's paper, I wish it to be understood that wherein I may have different views, what I say is not in a spirit of antagonism, but with a kindly feeling. It is only the desire to point out possible errors as to his theories, and to have others more clearly defined—to draw to your attention what appears to me an inherent weakness and the limitations of the appliance he so ardently advocates, and to use this opportunity to endeavor to set aright false impressions rapidly gaining ground through extravagant claims of others, as to the discovery in this appliance of a panacea for all our troubles. Most happily, the essayist makes no such claims.

We are, I believe, all in accord as to dependency of normal development upon proper nutrition and functional activity, particularly functional activity; but I do not remember that we earlier students of Orthodontia were taught or led to believe that the mere mechanical locking of the cusps and inclined planes was sufficient to cause the teeth to remain in normal occlusion. To the contrary, normal development and proper functional activity were prerequisite.

There can be no question but that there has been too much dependence placed upon the orthodontic regulating appliance, and like the essayist, I believe our problems will not be solved simply by their use, and that they must be studied from the standpoint of development and its relation to functional force.

The essayist states that most of the organs of the body are developed under their own function. This is particularly true, I believe, of the dental organs, but that they should be likened in their development in their entirety, to other organs of the body, is, I believe, a mistake. And as to the oral cavity, as an organ, being affected in its growth and development in proportion to normal and abnormal function of associated organs, that has, in my opinion, yet to be substantiated. Therein lies its difference to other organs of the body.

From the remark of the essayist in the course of his paper, it is assumed he is referring, in the main, to the permanent denture. In any case, taking him literally, we know the teeth begin to functionate actively before they are fully formed. The fact is, they should begin to functionate as soon as the cusps are through the tissues. He states that, for various reasons mentioned, primarily the orthodontic problem is not a tooth problem, and that malocclusion is undoubtedly the result of a functional disturbance in bone development together with its associated tissues, and that tooth occlusion is secondary, or a symptom, indicating only to a degree, the variations in the development of the bones of

the mandible and maxilla. If such be true, why is not the deciduous denture affected in like proportion to the permanent? Why does this disturbed function in by far the largest percentage of our cases, occur or become most apparent during the development of the permanent denture? Is this disturbed function due to intrinsic or extrinsic causes? It certainly does not seem reasonable that the deciduous denture should be affected so little, and yet the functional disturbance be due to intrinsic forces or functional disturbance in other organs of the body. In my opinion it will be found, after due consideration has been given to development and its relation to functional force, that the disturbed function in the dental organs is caused by the lack of proper extrinsic force, or in other words, nothing more or less than insufficient or lack of proper use, from the time the infant is old enough to stick its fists into its mouth, to the full eruption of the permanent teeth. And because of this, I believe the orthodontic problem will remain as much a tooth problem as a developmental one. Furthermore our troubles will be lessened but little by the further study or knowledge of development, or help from other fields of medical science, unless we can reform people as to their luxurious ways of living, and that does not look very promising.

I might state here that in my experience the larger percentage of the children I have been called upon to treat, have been, other than their teeth, anything but abnormal. In fact, many of them, almost one hundred per cent, were normal. I quite agree with the essayist as to the necessity of constructing and adapting appliances that will become auxiliary to and cooperate with the developmental forces, so far as it is possible, and still have them effective. But that they can be constructed without some rigid attachment and still be effective, in the larger percentage of cases, is a mechanical impossibility, and I question the statement that because of the use of so-called rigid attachments, the tooth is robbed of any of its function, or that the supporting bone degenerates to any appreciable degree; unless through faulty manipulation of the operator, and in that case, that would occur with any appliance, particularly so in the molar region with the lingual arch appliance, when the half-round tube and shaft is used as a molar attachment. I cannot see wherein the application of force from the lingual aspect would be any different than that applied from the bucco-labial aspect; one is a push, the other a pull; neither can the amount of force be more easily determined in one than in the other; nor can it be controlled to a better advantage in the lingual appliance than in the bucco-labial, and the fact that the enlargement of the dental arches is forward and outward does not necessarily contraindicate the use of bucco-labial appliances.

As to the advantages and disadvantages of the bucco-labial and lingual appliances, I will say, that in the former, it is adaptable to a wider range of cases, with molar anchorage kept more easily under control, a most important feature in any appliance; for it is in this region that we will find the greatest functional disturbance that is causing us so much trouble. Its disadvantages are mainly from a prophylactic and esthetic standpoint, and if not kept under the closest surveillance, it is liable to cause irreparable damage to tooth structure. The use of bucco-labial appliances, of course, necessitates the placing of retaining appliances after occlusal relations have been established.

The lingual appliance, unlike the bucco-labial appliance, is, from the esthetic standpoint, most ideal, and from the prophylactic point of view, is less liable to cause etchings of tooth structure, because of the action of the tongue and flow of saliva. In my hands it has proved a most ideal appliance in developmental work during the period of the full deciduous denture, in those cases of mixed dentures wherein the permanent teeth are in their first stages of eruption, in those simple cases of Class I of the full permanent denture, and in all of cases in which arrested vertical development is not present. In other types of cases, the appliance, in its present stage of development, is limited in effectiveness; and in all other cases it must be supplemented by other appliances.

It is a most ideal retainer; slight re-adjustments, when necessary, being made without difficulty.

Arrested vertical development in molar and premolar region is a most potent factor in producing malocclusions of the teeth, and is present to a greater or less degree in a very

large percentage of cases, and it is in such cases that the appliance is particularly lacking in effectiveness, for in its use it is impossible to control this development. Its greatest weakness is in its molar attachment. Being a rigid appliance, it does here just what the essayist claims an appliance should not do, namely, interfere with the developmental forces, for if the greatest care is not exercised in the manner of placing, and in the force exerted by the little auxillary springs, molar displacement is sure to result. Again, when occasion calls for an adjustment of the lingual arch, or repairs to be made to the same, the accurate realignment of the close fitting tubes and shafts, in the absence of suitable testing instruments, is practically impossible, resulting in molar displacement, usually in a direction not desired by the operator, and the degree depending upon his skill.

Much, however, may yet be done to eliminate this difficulty, mainly in perfecting an instrument to accurately gauge relative positions of tubes and shafts. When this is accomplished, this lingual arch appliance will prove most ideal in those cases as outlined above.

Dr. James D. McCoy, Los Angeles, Cal.—I am tremendously interested in what Dr. Mershon has had to say. In justice to him and to us all I wish we might have several months before attempting to put our thoughts into definite form. He has hit the nail on the head when he has classified the orthodontia problem as one of nutrition, and the sooner we learn more about that particular problem the better off we shall be. I have been faithfully endeavoring to follow out his principles in the use of the lingual arch over quite a period now, and the more I use it the more amazed I am at its possibilities. I made the fatal mistake about which he cautions us, i.e., I applied my force too rapidly and too frequently. I had the good fortune to have as a balance wheel in my office, my brother, who is very skeptical and who is better balanced than I. He was quite skeptical at first regarding the lingual arch, but as time has gone on he has finally become converted and is now as enthusiastic as I am.

I think a very important feature of our success in using this appliance will be found in the materials we use in its construction. It is certainly one appliance which will not stand the abuse of using inferior materials. I am anxious to have a consultation with Dr. Mershon in regard to his latest findings with reference to the alloys and where we may secure those best adapted for the appliances.

When I first started to use the lingual arch I adopted this plan, and I think any of you who have failed to use the appliance so far, may do well to follow it. I only used it at first on the lower teeth in Class II cases where it is indicated as anchorage in using intermaxillary force. I have finally reached the point where I never use any other appliance in these Class II cases except the lingual arch, and as I become more familiar with it I find it applicable to a greater variety of cases.

Dr. A. H. Suggett, San Francisco, Cal.—At the Chicago meeting two years ago I heard Dr. Mershon's paper and saw his slides, and was much interested in his work. I had been tinkering a little with the lingual wire, but felt I had to have a stabilizer in front, but when I saw his work I was certainly impressed with the results he secured. It is necessary to use a stabilizer if you use a great amount of force, of course, and it seemed to me it was necessary to use a considerable degree of force. Then we began to doubt if it was necessary to use so much force. But a few years ago you know, we used 16 gauge arches, and Dr. Angle is quoted as saying to some students they could look up and study other problems but improvements on D Bands and the Expansion Arch already made were final. We came down from 16 to 18 guage arches and to the pin and tube appliance with .030 wire. When J. Lowe Young gave his clinic in Chicago and told of this wonderful wire it seemed absurd, but still we were open to conviction and we commenced trying it, and at the time we got started on the 0.30 wire other men came out with .022 and .020 wire, and that seemed still more absurd. But when a man has shown the results that Dr. Mershon has shown, there can no longer be any doubt of the practicability of the method he follows, I think.

I may get results with one appliance better than somebody else, but that does not signify it is impossible to do the work with these other appliances, and we all realize that

we need less and less force. None of us can follow this paper to which we have listened and still doubt you can move those teeth with an almost infinitesimal force as compared with the old 16 gauge arch. We have mothers of patients coming in and telling us the children had to go every day to have the 16 gauge arches tightened up with hydraulic pressure. At Chicago one man showed a 14 guage arch, and somebody asked why he did not have jack (?) there! The more force the better! But we get the results with the slightest pressure and are realizing there is something beside tooth movement. I returned from Chicago enthusiastic about it, and commenced talking with the fellows out here. I realized that was the coming thing. That interested the American Society of Orthodontists more than any other thing before the convention at that time. and we are happy to have Dr. Mershon here today to show us what can be done. Since I attended that meeting most of all the lower cases have been treated with the lingual wire, but I have not applied it so accurately nor so scientifically as Dr. Mershon has done it. But I would like something to keep me from pushing my cases so rapidly, and then I will make better progress. I am sure I shall be the gainer from what I have seen today.

Dr. H. L. Morehouse, Spokane, Wash.—I would like to express my appreciation of Dr. Mershon's paper. I have been using the lingual arch for two years—not so fully as the Doctor has shown us but along nearly the same lines, and the results have, in a majority of instances, been very pleasing. I fully realize now what I have partly felt before, but did not put into effect, i.e., that I should move teeth with less frequent adjustments. Doubtless I have made the adjustments less frequently than some others, but I am certain after hearing Dr. Mershon's paper, that is one of the greatest points in his success. I wish to thank him for the paper.

Dr. Leland E. Carter.—I hesitate to say anything regarding this lingual arch as I fear I might say too much. I am a lingual arch enthusiast and I use it in the majority of my cases. I started out by using the Jackson appliance, which I use very extensively to this day. I have used Dr. Mershon's appliance in a great many cases, but found some trouble in stabilizing the wire, so I got into the habit of using Lourie's method of attachment, and in order to get my adjustments (a little hint I got from Dr. Suggett) I remove the Lourie appliance in making my adjustment—by removing the bands. It is an easy thing to do when you have properly constructed bands and a good band remover. Because of the fact these adjustments should be made less frequently than with some other forms of appliances, this is not as much work as one might think. I have used the auxiliary springs a great deal. When I first used them with the Lourie attachment I had a rather disastrous result. I did not figure correctly just how strong the little wire was and how fast it would move those teeth, but very shortly I discovered I had better apply less pressure and make the adjustments less often. I have been much interested in Dr. Mershon's paper and welcome the opportunity I will have of seeing him demonstrate the construction of this appliance, as I feel it has its advantages in that it may be removed from the mouth and adjusted so easily.

Dr. Mershon offered no closing discussion.

TECHNIC OF CONSTRUCTION AND ADJUSTMENT OF THE PIN AND TUBE APPLIANCE*

By George W. Grieve, D.D.S., Toronto, Canada

OVER a year ago a member of your society asked me to contribute something on the pin and tube apppliance. He had seen a number of patients in my practice whose cases were being treated with this appliance. I was unable to accede to his request at that time. Again this year the same appeal came to me from your society, and while I am very diffident about presenting such an important subject, upon which so very little has been written, I feel that possibly some of the members may derive more or less benefit from my experience with this most excellent appliance.

I might say that this is my maiden effort in the way of a paper before a society of specialists, and I trust that those who hear it today, or read it later, if it should ever appear in print, will be charitable and remember that only the work of Him who created all things is perfect. I trust it will be received in the spirit in which it is given, and that while it may be imperfect in many respects, this paper, nevertheless, coupled with the discussion which it may provoke, will, it is hoped, be of some little assistance to many who are working in this fascinating field.

I shall endeavor to give as clearly as possible a technic for the construction and adjustment of this appliance, and will say here that one of the chief features of difference, as I use it, compared with others who have so far written upon the subject, is not original, but was suggested to me about three years ago by Dr. C. A. Hawley, of Washington. I refer to the half-round pin, which I now use to the entire exclusion of the round pin. I do not, as a rule, use loops in the arch in front of the molars, but obtain increase or decrease in the length of the arch as will be described in detail later.

I am not going to go into the history of the development of the appliance other than to say that, as introduced here, it is a modification of, and in some respects, to my mind at least, an improvement upon the appliance as originally introduced by Dr. Edward H. Angle, before the Alumni Society of the Angle School of Orthodontia, and published in the *Dental Cosmos* for March, 1910, under the title "Bone Growing." Further papers were presented by Dr. Angle before the Alumni Society of his school, upon this appliance and appeared in the *Dental Cosmos* for August, 1912, under the title "Evolution of Orthodontia—Recent Developments," and in the same journal for January, 1913, entitled "Further Steps in the Progress of Orthodontia." In July, 1913, before the American Society of Orthodontists, that expert technician, Dr. J. Lowe Young, contributed a paper entitled "The Technique of the Practical Application of the New Angle Appliance." This paper appeared in the *Items of Interest* for

*Read before the Alumni Society of the Dewey School of Orthodontia, Chicago, April 1-2-3, 1920.

November, 1913. A paper by Dr. Allen H. Suggett, of San Francisco, appeared in the February, 1917, number of the *International Journal of Orthodontia,* entitled "The Use of the .0225 Wire." This was a description of the pin and tube principle in a considerably modified form. The original appliance of Dr. Angle, as well as the modified form of Dr. Suggett, are also described in Dr. Dewey's book "Practical Orthodontia." This appliance has been referred to in articles by Drs. Rogers, Pullen and others, but, so far as I am aware, nothing has appeared in the magazines in the way of definite articles relative to its use other than as stated above.

In a paper by Dr. A. Fernald, Boston, which appeared in the *Items of Interest* for December, 1912, he described the use of square pins soldered to the arch and square tubes on the labial surfaces of bands on incisors and canines to get rotation and root movement.

Just here I would like to pay my tribute to the master mind which gave us in this appliance the most perfect instrument, in my opinion, for the correction of those cases which require a multiplicity of movements of crowns and roots, that has ever been introduced. It was my privilege, along with other members of the Alumni Society of the Angle School of Orthodontia, to receive personal instruction from Dr. Angle in his clinics at New London in 1911 and again in 1912 upon the construction and adjustment of his pin and tube appliance. He gave to those whose privilege it was to study under him, inspiration and ambition, and instilled into our very souls those high ideals which go so far to make success.

In the pin and tube appliance, as I use it today, while I have adopted some of the changes suggested by other men, I have also sought to eliminate some of those which Dr. Angle considered undesirable, and as presented here, it is the most efficient appliance for the treatment of complicated and difficult cases that I have ever used. I have applied it, in different forms, upon a large number of cases since 1911, and my feelings concerning it can best be described, if I may be permitted, by quoting from the paper of Dr. Young in 1913, in which he said: "Gentlemen, I wish to say to you at the beginning, in all seriousness, that if, for any reason, I were deprived of these delicate appliances I believe that I should give up the practice of orthodontia." And I might say, personally, that I would be very sorry indeed to discontinue my efforts in this most fascinating field of work. There are many difficulties each day which we must overcome, but without difficult problems to solve the interest would be gone, and we would rank only with those in menial vocations whose energies are directed from year to year with the sole purpose of "making a living." The height of the ambition of many in this latter class would be to in some unknown and mysterious way secure money enough to "live without working." Work is looked upon by many of these men as an "invention of the Devil," while to others, who see ahead a goal of accomplishment which requires earnest effort to reach, their work forms a large part of "the joy of living."

Wonderful results may be accomplished by the use of the pin and tube appliance, but the operator who has not the skill or inclination to exercise the most exacting technic should not attempt its use, for without extreme care in its adjustment serious damage may be done. Dr. Young said in his paper on

this appliance:—"Remember that the highest kind of skill is purchased only by the most painstaking kind of work."

The technic of construction of this appliance with the half-round pin is still more exacting than that with the round pin, but after completion of the application of the appliance, particularly where there are a number of rotations to be made (which, by the way, is nearly always the case), I feel its adjustment is more simple than with the round pins.

It has been said of the pin and tube appliance that the technic of its use is too exacting for the average orthodontist. I believe this is not true, and I trust that those present who have not tried it, and those who have only tried it half-heartedly will go home and work with it earnestly; your efforts will be wonderfully repaid; its efficiency is 100 per cent. I believe that the man who cannot master the technic of this appliance will not be very successful as an orthodontist. I do not mean by this that successful results cannot be obtained without its use, for in this city of Chicago there lives a man who can, I believe, place teeth absolutely where he wants them without fixed attachments to any teeth except the molars, but to do that, in my opinion, requires more skill than is necessary to successfully use the pin and tube appliance.

PLACING OF BANDS AND TUBES

All teeth which require root movement or rotation, with a few exceptions, should be fitted with plain bands, upon the buccal or labial surfaces of which are soldered half-round tubes. The tubes should be placed parallel with the long axis of the teeth, regardless of the extreme angle of inclination which any may occupy. The tubes on the molars should be similar in size to those recommended by Mershon for use with the removable lingual arch, and be .08″ to .10″ long, and placed a little mesial to the centre of the buccal surface of the teeth. Where the second molars are present, bands with tubes should also be placed upon these teeth, as well as the first molars, if the former require movement of their roots or rotation, or if these teeth are required as additional anchorage to carry out movement of the other teeth. In many cases it will be found that the upper second molars stand at an extreme abnormal angle, their roots requiring to be carried buccally; these can be very perfectly straightened up with this appliance, thus improving their occlusion with the corresponding teeth of the mandible, which are often found at a more or less opposite angle. The lowers usually require their crowns to be "tipped" buccally, which can be accomplished by soldering a spring of .025 wire at right angles to the arch to lie between the distal cusps of the first molar and the mesial cusps of the second and then turned gingivally and distally to lie against the lingual surface of the second molar. If their roots require to be carried lingually, which is rarely the case, then these teeth should be banded as for the uppers. Occasionally the upper second molars will only require to have their crowns "tipped" lingually, in which case the arch proper is carried back to lie against the buccal surface of these teeth, and a separate lock of .025 wire is used to hold the arch to place in the tube on the first molar. The bands upon the molars, where possible, should be carried beneath the free margin of the gum; the same technic may be applied in second premolars or upon any teeth which are particularly

short, but for the most part all other bands are made just wide enough to carry a tube .08″ long and permit the arch wire to lie upon the band, as described by Dr. Angle in his original technic for the pin and tube appliance, and have space gingival to the tube sufficient to permit of a lock of .022″ wire which may be required upon any teeth to be extruded or for the purpose of holding the arch firmly to place in the tubes. All bands should be so placed upon the teeth that the arch wire, when the corrections are all made, will be, as nearly as possible, in harmony with the normal dental arch, as described more minutely by Dr. Angle in his papers referred to above.

In the adjustment of the bands, a central incisor is fitted so that its band rests in the desired position and the tube is soldered to place. This band is now placed upon the tooth, and all other bands are adjusted to conform to this one, those on the laterals being placed just a little nearer the incisal end of the tooth than the centrals, to compensate for the slightly shorter tooth. The position of the tubes inciso-gingivally, or occluso-gingivally, is located by measuring with the Hawley gauge, or some other suitable instrument, the distance

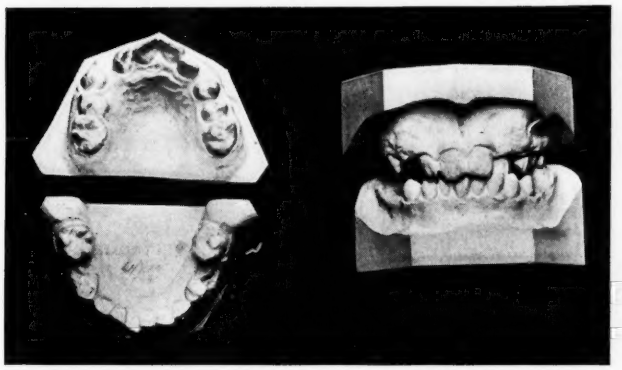


Fig. 1.—Shows labial and occlusal views of casts of a boy twelve years of age. There were many teeth rotated, and roots standing, in some instances, at decidedly different angles. This case is nearly completed after a little over two years' treatment. The pin appliance, with half-round pins, is particularly adapted for the treatment of cases of this type.

on the selected central from the gingival end of the tube to the incisal edge of the tooth, and making all to conform to this one, the distance in the case of the laterals and premolars being slightly less than that of the centrals and canines.

In placing the tube for soldering, it is laid upon the center of the band, after having placed a small amount of flux upon band and flat side of tube, as nearly as can be judged parallel with the long axis of the tooth, using the approximal sides of the band as a guide. The flux is now fused to "fix" the tube; then a tiny piece of 18 karat solder is placed alongside the tube and slightly fused. (The seams of the bands have been soldered with 22 karat solder.) A straight piece of the half-round wire is now placed in this tube from the incisal end, to project gingivally about half an inch or more, and, holding the wire by the incisal end, the band is turned so that the lingual surface presents toward the operator. It can now be seen, by studying the line of the wire with the approximal sides of the band, whether the tube has been correctly placed. If not so placed, the wire is removed and the band held over the blowpipe so that the flame strikes the inner surface of the band under the tube, and with

a very fine instrument the tube can be "kicked" in the direction desired just as the solder fuses, as suggested by Dr. Angle. All work of soldering of bands and tubes may be done by a young lady assistant. The band is now placed upon the tooth, the wire inserted as before and studied as to angle. If the tube is found to be improperly placed, it is handed back to the assistant for correction. When the tube is found to be properly placed the solder is fused perfectly. This band is now placed upon the tooth, and the bands for the adjoining teeth, which have been in the course of fitting in the interval, are trimmed to lie in their proper position. All bands for incisors and some canines are slightly stiffened on their lingual surfaces with 20 karat solder, as advocated by Lourie for the portions of molar bands which have been burnished into grooves. This precaution is a good one, as it prevents the band, after being cemented, from pulling away from the concave lingual surface; this stiffness of the band also facilitates its correct placing upon the tooth when cementing. In the construction of bands, where tubes are to be used on their labial or buccal surface, they must not be pinched on this surface, but a lap joint does not interfere with the placing of the

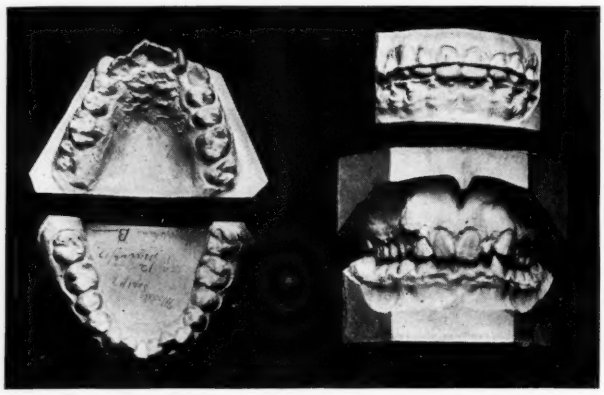


Fig. 2.—Shows labial and occlusal views of casts of a girl twelve and one-half years of age. Also illustrates cast made recently from labial impression showing appliances. This case is nearing completion after two and one-half years' treatment.

half-round tube. The tubes for all but the molars should be the smallest obtainable, and, as suggested to me by Dr. Hawley, be .08″ long. I have not been able to obtain tubes and wire for this purpose as small as I would like, for a very delicate pin will do the work required just as well as a larger one, and the arch will be just that much more resilient. When all bands are completed as above outlined, they are polished and cemented to place. The construction of the arch should not be commenced until a subsequent appointment.

CONSTRUCTION OF THE ARCH

The amount of the arch wire is ascertained by the assistant as suggested by Dr. Angle. The end of a piece of heavy ligature wire is placed at the buccal groove of the first molar and is burnished to the buccal and labial surface of all the teeth until the same position on the opposite molar is reached. To this length of wire is added about two inches; the ligature wire is straightened out and an equal length of the arch wire is marked off. The extra two inches of arch wire is to allow material for the Angle Young locks for the first molars

or to extend to the second molars if necessary, and a little extra for safety. If for any reason loops are required in the arch, a sufficient amount of arch wire is provided. The arch wire is then cut off. The assistant now solders, with 20 karat solder, at right angles to the arch wire, within ⅝ to ¾ of an inch from the right or left end (the writer prefers to commence at the right side) a piece of the larger half-round wire.

Care should be taken to have all pins soldered true on the arch buccolingually and with the wide diameter of the pin wire parallel with the arch wire. All pins should be soldered at right angles to the arch, regardless, as before mentioned, in connection with the placing of the tubes, of the angle of inclination of the teeth. The half-round wire is now cut off and the end filed flat so that the pin is just a shade shorter than the tube into which it is to fit on the first molar band. The decided angle at the end of the pin is now slightly rounded with a file to facilitate its entry into the tube. (This technic should be followed with all pins.) The arch is now ready for the operator.

An important detail in the construction of the arch is to have as nearly as can be judged the correct amount of arch material between each pin. If teeth are tight together the arch should be bent over the round or oval beak of the pliers right into the interproximal space as far as possible and then bent sharply back over the flat beak of the pliers, and again lingually over the oval or round beak to lie close to the tooth. If this will not give sufficient arch wire, then a slight loop may be made, just sufficient to allow the correct amount of arch material. If, on the other hand, the teeth are somewhat separated, the arch should be carried straight from one pin to the other. If, however, teeth which stand apart are rotated, this will not be possible. In adjustments of the arch later in treatment, where the arch has been carried close into the interproximal spaces, it is gradually straightened out sufficiently to relieve any crowding, and where the teeth stand apart the straight arch is gradually shortened by being bent into the interproximal spaces. If at any point in treatment the arch material has been fully straightened out to relieve crowding, and it is found there is still not sufficient arch material, as will occasionally be found in crowded lower incisors, the arch wire may be slightly stretched by being carefully pinched with Dr. Angle's wire stretching pliers. If too much arch wire is present to permit bringing any teeth together by bending it into the interproximal space a slight loop may be made. Teeth which stand some distance out of line, or at too extreme an angle, may sometimes be handled with the spring, as will be described later, or a loop may be used. The pins are so short (.08″) that it is usually possible to place them all in the tubes except in very rare cases, even though some teeth may stand at quite extreme angles.

An infinitesimal amount of solder is used to attach the pins, and any excess which would prevent the pin from going right home in the tube should be removed with a very fine flat file, the operator using a watchmaker's glass if necessary while doing this filing, in order to prevent marring the pin. (For those wearing glasses one may be obtained with a coiled spring which hooks on to the lens.) In some instances, when constructing the arch, the bends in the latter may prevent using a file upon the pin, in which case a very fine mounted stone, driven by the dental engine, may be used for the purpose.

The technic for the use of the solder in attaching the pins is that suggested by Dr. Ketcham long ago of flowing the tiny piece of solder upon the gingival aspect of the arch wire at the point of the scratch previously made. The writer's technic is to make a nick with a sharp file on the lingual aspect of the arch, after its removal from the mouth, opposite the scratch; then the solder is slightly fused on the arch, and if too much solder or heat has not been applied the nick will still be visible. The advantage of having the nick on the lingual is that the flat side of the pin wire presents to the operator while soldering, which facilitates its correct placing on the arch.

The half-round wire for the first molar is now placed in the tube on that band and the fitting of the arch commenced. If the second molar is present, and is to have an attachment to the arch, it will have been previously banded, and the arch is bent to lie against the surface of the band on the first molar, bent into the interproximal space, and conformed to the surface of the second molar band, and made to lie in its correct position at the mouth of the tube on that

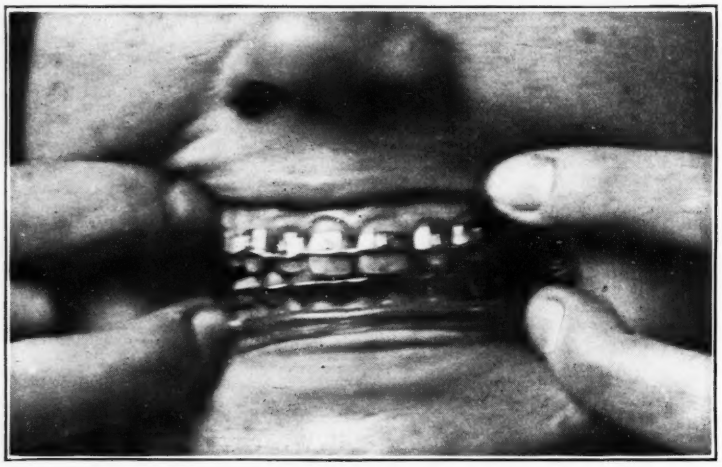


Fig. 3.—Shows appliance in mouth of a young lady seventeen years of age. This is a particularly difficult case, requiring many rotations and much root movement, which can be handled with this appliance, in the author's opinion, more successfully than with any other known appliance. Case has been under treatment for a year and a half.

tooth. The center of the tube is now marked on the arch with a lancet or fine file, the arch removed and the pin soldered. The arch is allowed to extend a little beyond this pin, lying close to the band. The arch is now replaced, allowing only the second molar pin to enter its tube and the first molar pin made to lie buccal to its tube. The relation of the arch and the first molar pin to the tube on that tooth is noted, the arch removed and any change which may be necessary to make the pin telescope the tube to its full depth and lie passive is made by bending and twisting the arch wire itself. The arch is now replaced in the same manner, and when found to be correct, as nearly as can be judged, the pin is withdrawn from the tube on the second molar and that for the first molar is inserted in its tube and the relation of the pin to the tube of the second molar noted. When found correct, withdraw the pin slightly from the first molar tube and insert both pins to their full depth into the tubes. The arch is again removed and bent to conform to the surface of the first molar band

mesial to the tube to the line of contact between this tooth and the second premolar, then bent back first buccally and then lingually and made to lie close to the surface of this tooth or its band, if it has one. The detail governing the amount of arch wire between the pins as described above, must be followed. The position for the next pin is marked as before stated, the arch removed and the pin soldered. The arch is now replaced again with the pins in both molar tubes and the relation of the last attached pin noted. The arch is again removed and any changes necessary made, then replaced as before. When the arch is found correct, it is withdrawn from the molar tubes and the premolar pin only inserted. The relation of the pins to the molar tubes is now noted, and when all is correct, the pins are placed in all three tubes. After each pin is attached and placed in its tube, the line of contact of this tooth with the next one to be fitted may be marked on the arch by means of a scratch, thus locating definitely the point at which the arch must be turned sharply back to the buccal. Steps up or down in the arch may be required at certain points indicated by the positions occupied by the individual teeth. It is not necessary to place all pins in the tubes each time the arch is replaced, but the arch may be slightly bent buccally distal to any pin and only about two or more pins placed while conforming the arch to the other teeth. This detail of fitting and attaching the pin is carried out until the molars of the opposite side are reached, fitting forward and back alternately.

Now after careful adjustment, inserting first the pins in the tubes on one side and noting the relation of the arch to the remainder of the teeth, making any adjustments necessary, then inserting the pins of the opposite side and doing likewise, then those in the incisal region are placed and the position of the arch noted at both buccal ends and any necessary corrections made. The arch will have to be bent buccally in placing during this procedure to prevent "binding" which would interfere with the passive resting of the arch. When the arch seems to lie perfectly after this final truing up, the bends formerly made to facilitate placing of certain pins in their tubes without inserting all pins are now straightened out and the arch placed as nearly as possible with the pins alongside their respective tubes to check up the width of the arch. All pins are now placed in their tubes. When found correct, the arch should be removed and any locks necessary placed, the arch carefully adjusted again to detect any change due to soldering the locks, the appliance cleaned and inserted, to remain for a week or ten days without action.

Where no movement of the second molars is required the end of the arch wire is bent around to lie gingival to the tube on the first molar to form the Angle-Young lock.

I have been using the free hand method of holding the pin material while soldering to the arch, but I feel that the spring soldering tweezers designed by Pullen for holding the arch and round pins while soldering could be modified to hold the half-round pin material, without cutting the latter until after soldering.

Two or three pairs of pliers will be found to cover all requirements of the work of bending the arch, viz., the Young pliers, designed especially for manipulation of the pin and tube arch, a pair of flat-nosed pliers with as narrow a beak as it is possible to obtain them, and a pair with one flat beak and one oval or

round beak, such as those made by the S. S. White Company, Nos. 118 and 189. A bend is often desired immediately alongside a pin, either on the verticle or horizontal plane. This can be obtained by grasping the arch wire with a pair of flat-nosed or No. 118 pliers right at the attachment of the pin, and with another pair of the same pliers, or a pair of Young pliers, grasp the arch close up to the pin and give the necessary bend. If torsion is required, two pairs of Young pliers may be used on the arch wire as described by Young in his paper referred to at the beginning, or by one pair of these and a flat-nosed pair, the latter grasping the wire right over the pin, as above described, and the Young pliers holding the arch as far distant as desirable. The arch should be kept annealed as perfectly as possible during the whole operation of adjustment.

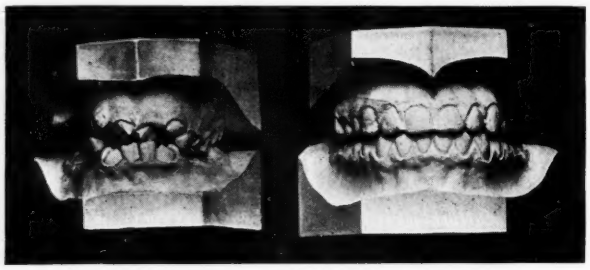


Fig. 4.

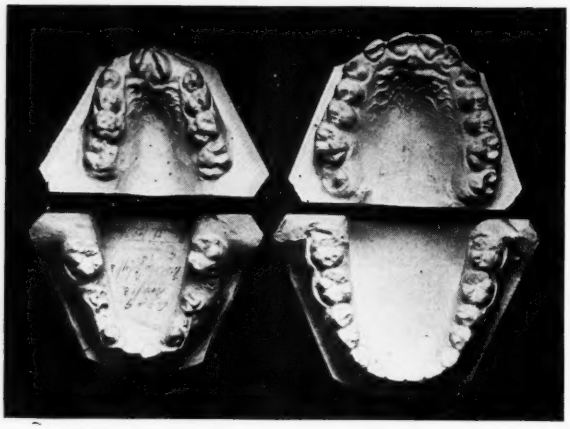


Fig. 5.

Figs. 4 and 5.—Illustrating labial and occlusal views of casts of a case of a little girl under nine years of age, with extremely narrow arches. The pin appliance was used upon this case in the later stages of treatment only. A little more work is necessary upon incoming cuspids and second molars.

MATERIAL AND SIZE OF WIRE

The material of which this arch is made is the well known "E" wire. The size I use mostly is .028, but in many cases recently, where the patient is very young or where there is very little expansion of the dental arch required, but requiring probably a good many rotations and the angle of inclination changed in many teeth, I have been using .025. I believe the .022, as used by Drs. Robinson, Suggett and others in this and other types of appliance, will be heavy enough in some cases, particularly where the teeth to which attachment is made are close together.

It is desirable that the pin material be made of the same metal as the arch, or something very similar. The pins are so short that spring is not necessary, but should be hard enough to prevent twisting or bending. The active force to obtain all movements is supplied by the arch.

It might be stated here that the tubes and pin wire obtainable at the present time for the teeth other than the molars is much too large. A very delicate and much smaller pin would be preferable. At the present time the pin material supplied is not straight, and it would facilitate matters if it were. It is also twisted upon itself, which is a great disadvantage. The pin wire and tubes are not always uniform in size; this causes a great deal of inconvenience and should be remedied.

Before the adjustment of the arch is commenced a diagram of its shape is drawn by the assistant. The detail of this is as follows: A straight line is drawn upon a piece of paper, and the distal of the molar half-round pins, if they are symmetrical, are placed at this line. Now with a very sharp pencil trace the inner line of the arch on the paper. The arch must not be touched to steady it, in any way, as it might thus be somewhat distorted. If the pencil accidentally touches the arch and moves it, the arch must be replaced in position. If the most distal pins are not fitted to diametrically opposite teeth then two straight lines should be drawn on the paper, one for each molar pin, so that the draft or sketch will be symmetrical or balanced on the paper. This sketch will act as a guide in "checking up" after making changes, and while not accurate, it is, nevertheless, of considerable assistance. It is desirable to keep at least the original sketch, marking it "original" and putting on the date. I might say here that the same principle is applied by me in the use of the removable lingual arch of Mershon.

ADJUSTMENT OF THE ARCH

The detail of the adjustment of the arch in treatment is very similar to that of its original construction, added to which, of course, will be the consideration of anchorage and resistance. The principle of reciprocal anchorage, as in all other appliances, should be utilized to the fullest extent. As described by Dr. Young in his paper, too much work must not be attempted at any one time, but the resistance of the teeth utilized from time to time as anchorage must be carefully studied, so that undesirable movements will not take place. If more expansion is required on one side of the dental arch than on the other, then some of the pins eventually required for the side requiring the greater amount of movement must not be attached at the beginning, but the teeth of that side carried out one or possibly two at a time, after the same principles applying to all other forms of appliance. Occasionally it may be found that certain teeth on the side requiring most movement buccally only require "tipping," in which case the work is facilitated; or occasionally it may seem advisable to "tip" certain teeth and straighten them up later with a pin. The requirements of each individual case will, with our knowledge of this and other appliances, suggest the procedure.

The technic of carrying teeth laterally along the line of the arch was carefully described by Dr. Young in his paper referred to earlier. This consisted of carrying one tooth at a time, using all the other teeth as anchorage. Often teeth,

particularly lower incisors, lean to one or the other side and require only their crowns "tipped." In this case, after obtaining the necessary expansion and space, the pin is removed from the tooth first to be tipped, and either a silk ligature applied or a spring of .022 wire attached to the arch and made to rest against the approximal surface of the tooth to be moved, or the end of the spring may be turned at right angles and made to drop into the tube on the band, the arch being adjusted to rest away from the end of that tube sufficiently to permit of this. After the tooth is tipped to place, the pin is replaced and the same procedure carried out with the rest of the teeth to be so moved. Where a tooth is overerupted, it can very nicely be depressed by a spring attached in like manner, or one occupying a position some distance away from the line of the arch can be moved into position by means of the same principle. A half-round pin is soldered to this light spring if it is desired to carry the tooth bodily and perhaps rotate it at the same time.

When decided rotation of upper premolars is required, a spur is soldered on the lingual surface of the band for the use of a ligature in the regular way, and the pin for this tooth is not put on the arch until the tooth has first been rotated, when the pin is attached. All other teeth, except possibly in very ex-

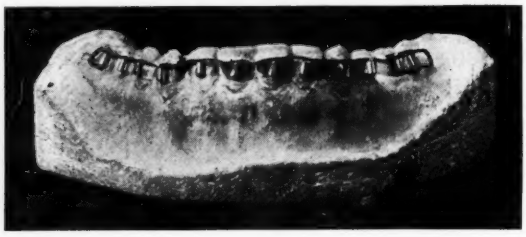


Fig. 6.—Illustrates lower cast of a case of a little girl twelve and a half years of age, in which the arch is slightly contracted and every tooth rotated. The bands were fitted in the mouth and transferred to impression, from which the model was made. The arch, which was made of .022 wire, was constructed on the model. This appliance was made for the clinic. In practice the arch should always be constructed upon the natural teeth.

treme cases, are rotated by the arch proper by means of the half-round pin, or by the spring as before mentioned. The one great advantage of the half-round pin over the round one is to obtain these rotations, of which there are many. The pin itself is not bent for any purpose whatsoever, the whole action being obtained by the manipulation of the arch wire. Upper canines, which so often, in Class I cases (or, in the terminology of this society, neutroclusion) are found to occupy a position of buccal occlusion and leaning toward the median line, can best be "tipped" to place by means of a spring of the .022 wire attached distal to the canine. It is often not necessary to band these teeth at all.

It is frequently necessary to carry the apices of lower canines buccally. To accomplish this it is wise to utilize all the other teeth as anchorage. Any teeth requiring tipping of their crowns are carried to place either with a spring or a ligature. In the case of molars, to which it is necessary to have the arch attached, requiring their crowns tipped, this may be accomplished in different ways. A very desirable plan is to slip over the distal end of the arch wire a round tube which just fits, to which tube has previously been soldered the half-round wire for attachment to the molar. If the bite is too close to permit of this, the arch may be cut anterior to the molar and the tube soldered to the

molar end of the arch wire and the anterior end allowed to telescope the tube far enough to be efficient. This latter idea I utilize considerably also with the removable lingual arch of Mershon, either on one or both sides, as indicated, and find it works beautifully.

The pin appliance is very efficient where incisors are to be depressed and premolars extruded, the arch being adjusted to rest a little occlusal of the tubes on the premolars and to press gingivally on the incisors. Locks must be placed to hold the arch snug in the tubes on the premolars. The writer has not evolved or yet seen a very neat form of lock for the pins other than on the molars, but is using so far just the Angle-Young principle. The pins may be left a little longer than the tube and a wire ligature used, but this wire should be of precious metal, as the brass ligature discolors the band decidedly.

Where all four incisors require to have their apices moved, they can usually be carried simultaneously if there are attachments to at least three of the buccal teeth on each side. With less anchorage, not more than two incisors should be moved at a time.

Many rotations can be carried on at the same time, giving to each tooth very little action at each sitting. The arch is bent close to the pin to give the rotation necessary and then counteracted immediately beyond the pin again.

Where considerable change is to be made in the arch, care must be taken to put action in one section at a time, keeping the balance of the arch as control, as suggested by Dr. Young. When changes are completed in one section, its relation can be noted and this portion used as control while another section is being changed. The last changes to be made at each sitting should be those to obtain apical movement.

Where the arch wire is twisted, as suggested by Dr. Young, to change the bucco-lingual (or labio-lingual) angle of any pins or pin, great care should be exercised in counteracting this twist distal to the point where action is desired, not to put too much power on any teeth. After twisting the arch it should be very carefully fitted, first one side of the changed area and then the other, as suggested earlier in the detail of construction of the arch.

It is not desirable to readjust this form of appliance more often than once a month, and, with a still lighter wire than the .028, more action can be put in as suggested by Robinson, and the changes made at much longer intervals.

I have found in the preparation of this paper that it is impossible to give every detail in so exacting a technic without making the paper much too long, and I must thank you for your kind indulgence during my presentation of the subject. I realize, too, that it has been compiled in a most rambling sort of way. Much of what I have said here is probably not new to any of you; a great deal, too, is not original, and if I have failed to give credit where it is due, it is because of my lack of knowledge of the literature.

In closing I would say that any operator who will exercise care and skill in the use of this appliance will obtain most gratifying results in the treatment of the most difficult cases.

It is my desire here, also, to extend my sincere gratitude to those men whose ideas I have copied. If there are errors in my technic, or improvements which may be suggested, I shall be glad, indeed, to have some mention of them in the discussion.

DISCUSSION

Dr. Adelburt Fernald, Boston, Mass.—I have been very much interested in this paper, and especially in the beautiful results the essayist has shown us. I have used the pin and tube appliance very little, not enough to discuss the subject intelligently, but I think if any one can produce the results that the essayist has shown us, it proves that he is a master of that method.

I would like to ask the essayist to tell us how long it takes him to treat one of these cases. For instance, the first case. The time he began until the time when it was finished.

A number of years ago I experimented with a square tube; I got results that seemed satisfactory in my hands, but still the results were not quick enough by that method. The patients would go away and when they returned the appliance would be bent out of shape or dismounted. Perhaps the fault was in my technic in not making the right models. The pin would break off and I would lose what I had gained. I gave the method up and took up other methods that in my hands were more efficient, and I got results much quicker than with this method. As I have said, it may have been due to my faulty technic and not to the materials that I used.

Dr. C. A. Kennedy, Toronto, Ontario, Canada.—I have not used this pin and tube appliance enough to comment on it. I have seen some of the results that Dr. Grieve has obtained from it and they are admirable. He accomplishes by this method features that seem almost impossible with other methods.

The technic Dr. Grieve uses is very exacting. I do not think myself I would have the patience to go at it in the way that he does.

One great difference which he does with his method is that he makes his labial arch to correspond to the malocclusion. Then he straightens out his arch wire to the form of a correct occlusion, so when his labial arch is straightened out, his teeth should be in proper alignment.

Dr. Sydney W. Bradley, Ottawa, Ontario, Canada.—I think I am perhaps mostly responsible for Dr. Grieve giving us this valuable paper. I wanted to give all of you the opportunity that I have had to see some of Dr. Grieve's work. I have seen some of his admirable work and during the past two years I have been trying to use the half-round pin and tube appliance and find that I am getting better results. The technic is very exacting, but it is worth while. I use it more for finishing up cases, using silk ligatures to bring the teeth into fairly good alignment, then using the half-round pin and tube to finish the case, I put the half-round tubes on the bands at first even if I may not use them for months afterwards. I believe with this appliance we have better control over the individual tooth than perhaps with any other appliance. I hope I shall have the patience to master the technic as Dr. Grieve has done.

I would like to ask Dr. Grieve if it is elastic wire he uses for the arch.

Dr. Grieve.—It is E wire.

Dr. Bradley.—This morning, when Dr. Johnson was reading his paper and advocating the use of heavy bands to prevent the occlusion from bending the edges I remembered a point which Dr. Grieve gave me and which I forgot to bring up at that time. It is to flow solder in the lingual and buccal grooves of your molar bands. This will strengthen the band greatly on the occlusal edge.

Dr. D. S. Sterrett, Erie, Pa.—In the application of force in the use of pins as described by the essayist, apparently the attachments will move teeth if the appliance attached to the teeth to be moved is quite accurate and fixed and very easily corrects any maladjustment toward the anchored teeth.

It was further brought out by the essayist that where any number of teeth are to be moved the pins for these teeth should be put on one at a time and a number of teeth pitted against them. I wonder whether it would be feasible to reenforce the anchorage or stability of the molar teeth by some application of the soldered lingual wire as was described yesterday.

A further question occurs in seeing the slide representing this appliance on both upper and lower teeth at the same time. It is my impression that this appliance offers a gentle resistance. It has been my observation that the pressure exerted by mastication is not a gentle force, but a rather severe force. It must be considered in its effect upon the lower teeth. I wondered how much it was safeguarded, how the arch of the lower teeth is safeguarded against a severe cross action of the upper teeth?

Dr. W. W. Woodbury, Halifax, Nova Scotia.—I had great pleasure in seeing practically the way in which this appliance works when in Toronto recently.

There is one thing I would like to point out, and that is, the *short* pin and *short* tube. We were taught first to put these tubes on the individual anterior teeth parallel, and the pins were slipped up paralleled. The short pin allows the essayist to put the tubes on the anterior teeth so that each one is parallel to the axis of the tooth. You are thus working toward the normal with the appliance, as well as toward the normal occlusion. In the old way, when you start the pins parallel, as the teeth come into occlusion the pins get further away from being parallel to each other. In this case, when you finish your pins are all parallel, and in that way it seems to me, it is easier to manipulate the appliance.

The essayist showed the importance of carefully placing the bands so that the tubes are all about the same distance from the incisal edge. Thus the wire is finally straightened out as the correct occlusion is finally brought about. These are points that interested me very much.

Dr. Addison E. Kingsbury, Columbus, Ohio.—I have never used the half-round pins, although I have used the ordinary pin and tube appliance a great deal, as Dr. Young demonstrated here in Chicago, and I must say some of the best results I have obtained I have secured with the pin and tube appliance. I can see how the half-round pins would be a great help in taking care of the rotation of a tooth, and I shall be glad to try them. I think the pin and tube appliance, when used intelligently, is by far the most efficient appliance that we have. I feel as Dr. Young expressed himself in regard to it—I never had the feeling of getting away from tinkering orthodontia as when I got to using the pin and tube appliance.

Lately, I have been using it in a way which I think may be of some help to one who wants to take it up again. I use .030 wire that Dr. Angle suggested in the tube and pins which I got from White's original idea, but in a great many cases, uncomplicated cases, which Dr. Grieve showed at first, I have been in the habit of putting on .031 wire with the plain bands and loops in front of the molars, and having the bands on the incisor teeth but not cementing them at first. I would use temporarily and ordinarily the Magill band and spur and do a great deal of expansion and rotation, proving up the bands before I put on the nut. It seems to me, where you adjust an appliance once a month, in a year's time it is quite possible you would not in a complicated case have much progress to show for your time. Your patient might be discouraged, or you might be discouraged yourself. By doing this preliminary work and using the appliance more as a contouring and retention apparatus, it is certainly a very valuable appliance.

In my opinion one of the greatest advantages of the pin and tube appliance is that you have almost absolute control of anchorage. In a Class II case, where it is desirable that most of your readjustment should be made, by moving the lower teeth or the lower arch, or even the mandible forward, you have in this pin and tube appliance on the upper absolute anchorage, and I am using it now in connection with lingual arches on the lower, and although the technic requires care, I find this appliance so valuable that I would be loath to give it up.

Dr. Grieve, (closing the discussion.)—Dr. Fernald, in his discussion, spoke of the length of time it takes to treat cases with this appliance. You can get results as quickly with this appliance as with any other. You have absolute control of the teeth and can move them as rapidly as you desire, the fixed attachment to the teeth, particularly where there are many rotations necessary, being much better than ligatures.

I have quite a number of arches in use made of .025 wire, but have so far only used one made of .022 wire. The majority, however, in my practice, are made of the .028 wire.

Dr. Fernald referred to a case, a slide of which was shown on the screen. That case was handled nicely in a year. A slide was shown of a very decided case, the teeth of which are getting pretty well in position at the end of two years' treatment: also another, showing a little labial impression above the ordinary pair of models, which has been under treatment for two years, and the teeth are getting pretty nearly into normal relation.

Dr. Sterrett in discussing the appliance, if I understood him correctly, voiced the opinion of a great many men, and, if I remember his point, it was this: An appliance, such as the pin and tube, is too rigid; it does not permit of the individual movement of the teeth which it is desirable to have. I appreciate, as much as any of you, the importance of permitting the forces of occlusion to operate unhampered by the appliance, but there are cases in which the angle of inclination of many of the roots is such that the forces of occlusion will never succeed in placing them at their normal angle of inclination. You must have something in the way of a fixed appliance in these cases. I prefer to use a lingual arch, as Mershon recommends, in preference to any other appliance, where it will do the work, but there are, in my opinion, many cases where it will not do the work.

Major Eby spoke of the Jackson appliance. I do not use it, but I can see its advantages in some cases, if skillfully adjusted, but I feel that it must be more or less difficult to keep the appliance from impinging upon the soft tissues. He spoke also of Dr. Angle's ribbon arch allowing the teeth more play, and thus superceding the pin and tube appliance. I think Dr. Angle's ribbon arch will neither supersede nor be the equal of his pin and tube appliance in efficiency. I used the ribbon arch in only a dozen cases, and was able to get most of the movements I desired, but could not get a lateral "tipping" of roots. It seemed to me that the sides of the bracket sloped so that the little U cleat, soldered to the arch, did not grasp the bracket sufficiently firmly to permit of "tipping" the root, although the teeth could be moved bodily in a lateral direction. With the ribbon arch, if you have attachment to the first molar, you cannot get attachment to the second premolar, which often requires some root movement as well as rotation. It may have been due to my lack of skill, but I found the technic of the ribbon arch, when used upon cases requiring a multiplicity of movements, much more difficult than the pin and tube appliance and not nearly so efficient as the latter when used with a half-round pin.

To gauge the amount of twist given the ribbon arch, some one suggested little extensions of wire, one with a slot to grasp the arch, and another with a flat end to place in the bracket. With the aid of these extensions one could see the amount of twist given the arch. That no doubt would be an advantage, but I have never used it.

I believe that the pin and tube appliance, when used with the half-round pin and the Angle-Young attachments to the molars, in difficult cases where much root movement must be made, has no peer today.

One of the speakers referred to the application of force and the reinforcement of the anchorage by the addition of the lingual arch. The reinforcement of molar anchorage with the lingual arch, as suggested by Dr. Dewey, is an excellent idea, if there is a tendency for displacement of the anchorage, and I have utilized it in some cases. I do not use a fixed (or soldered) lingual arch as advocated by Dr. Lourie.

Some gentleman spoke of the force of the appliance and asked if it would not be antagonized by the greater forces of occlusion. We know the normal stress of occlusion is a very important factor, and the absence of the normal function of mastication accounts for the large number of cases of malocclusion. We all realize that if from the time the deciduous denture was nearly complete children were trained to masticate thoroughly, there would be a much smaller percentage of malocclusion, and not so much stomach trouble and intestinal derangement.

Using a delicate pin appliance, with the .022 wire, in a case such as that which will be shown in the clinic, where the attachments are close together, it seems to me that it would be impossible to obtain such efficiency with any other form of appliance, and the forces of occlusion will not combat the force of the appliance if the latter is intelligently adjusted. You must adjust any appliance in such a way that it will work in harmony with the natural forces of occlusion.

Dr. Woodbury emphasized the importance of having the pins attached at right angles to the arch and the tubes placed parallel with the long axes of the teeth. With this technic, when the construction of the arch is completed, the pins may stand at varying angles to each other, but when adjustment of the arch is commenced, you gradually work all the time, not only toward the normal shape of the dental arch, but also toward the bringing of the pins parallel to each other. In other words, in the adjustment of the arch, you are working always toward the normal in every respect. The more exact the technic, the more pleasure you will have in working with the appliance, and the more perfect will be the result.

Dr. Woodbury said this is the most efficient appliance we have. I believe there can be no doubt about that. I have used the pin and tube appliance ever since its first introduction by Dr. Angle in 1910.

Dr. Kingsbury said he would start these cases without any pins on the arch except those for the molars, and would use ligatures on all other teeth and place his pins later. In my experience, ligatures are not nearly so efficient as the half-round pins, even for rotations, except in those instances which I mentioned in my paper, where rotation of the upper premolars is required. These teeth often require the lingual cusps carried either mesially or distally, and this can best be accomplished by means of ligatures. If a premolar must be carried distally, the ligature may be attached to a spur on the molar and not to the arch. If the tooth requires to be carried buccally also, another ligature may be attached to the arch, and when you get the tooth or teeth rotated a pin should be placed on the arch to hold it.

Dr. Kingsbury spoke of using the pin and tube appliance on the uppers where you require good stable anchorage to carry the lower teeth forward. There are not many cases where the lower teeth have to be carried forward in the mandible. In most cases where there is a distal occlusion of the lowers it is the mandible which is at fault. Where the teeth do occupy a distal position in the mandible it is usually necessary to carry them forward bodily in an upright position, and even carry the apices of the incisors more than the crowns. Mershon says that with the lingual arch, placed low down, with slow movement you have the teeth carried forward in the upright position through the effects of normal function of the lips. There is no doubt that is true to a certain extent, but where a great deal of root movement is required I prefer an appliance which will act independently of lip function, for these patients are usually mouth breathers and lack that normal lip function which is so indispensable if a lingual arch is used.

Dr. Lourie's idea of a high (or low) labial arch with light springs extending to nearly the incisal ends of the teeth embodies the same principle. This arch will accomplish what is wanted in the hands of Dr. Lourie, or in the hands of expert technicians who have had a great deal of experience with that form of appliance. It is ideal, but I think it requires more skill to handle a case with the springs, where you require rotations and root movement, than with the pin and tube. It is not so difficult to get labial movement of the apices with the springs as it is to obtain lateral tipping.

I know the fixed appliance has its disadvantages in that it does not allow the freedom of the teeth which they might otherwise have, but if great care is used in the application of the force, and good judgment in adjustments, I believe there will be very little undesirable effect upon the soft tissues and underlying bone from the use of the pin and tube appliance.

It was asked whether I use this appliance as a retainer or adjust some other form. In some cases, particularly on the upper, I remove the pin appliance within a very few months after all teeth are in position, and do not put on any other, except that I might place an odd band with spurs to hold teeth which had been rotated. On the lower arch I would take off the pin and tube appliance and adjust a removable lingual arch as a retaining appliance, allowing the normal action of the lips and cheeks to close any slight spacing which might exist. By using thin banding material you will have very few spaces when you get through if you are careful in your treatment.

Lastly, the pin and tube appliance, if properly placed, is a cleaner and safer appliance to use, from an hygienic standpoint, than any other fixed appliance.

HISTORY OF ORTHODONTIA

(*Continued from page* 368.)

By Bernhard Wolf Weinberger, D.D.S., New York City

CLARK L. GODDARD, A.M., D.D.S., (1849-1905). *Goddard* spent considerable time studying odontology and succeeded in gathering together a large variety of skulls and teeth. He was particularly interested in the study of the cingulum and cusps of human teeth, with a view as to their evolution.

His first paper on irregularities of the teeth was read at the Ninth International Medical Congress, Washington, in 1887. Before the World's Columbian Dental Congress, 1893, he brought up the question of *Separation of the Superior*

Fig. 1.—Clark L. Goddard (1849-1905).

Maxilla at the Symphysis. In this paper *Goddard* explained his method of accomplishing this task by using a combination of appliances, first using the jackscrew. He had found that only two cases of forcible separation of the maxillæ at the median line had been reported, one by *W. B. Kingsbury* and the other by *E. C. Angle.*

"In *Dr. Farrar's* book the possibility of such a separation is mentioned, also the fact that it sometimes happens, and plans are given for preventing such an

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occurrence (p. 182). No pain or discomfort accompanied or followed the case *Goddard* described. He kept the arch spread, thinking that a deposit of osseous material in the suture would help to retain the extra width of arch that he had gained and give the room needed for correcting the irregularity of the incisors. The centrals were rotated and the laterals drawn forward till they assumed their proper positions.

"To correct the irregularity an appliance was inserted with a jackscrew for spreading the arch. The nut of the screw was turned twice daily and the arch spread without pain till in about three weeks the teeth presented the appearance shown in the model.

"By measuring from the buccal surfaces of the first bicuspid it is seen that the arch is spread exactly one quarter of an inch. You will notice that the appliance is attached to the first bicuspid and the first molar on each side, but does not come in contact with any of the six anterior teeth. Now comes the surprising part, that the spreading is not confined to those teeth only to which the appliance

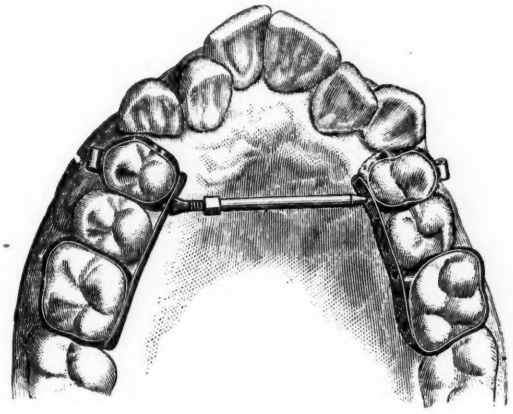

Fig. 2.

is attached, for the central incisors which previously overlapped are now separated by a decided space. Upon making accurate measurements we find that the cuspids have spread apart $\frac{3}{32}$ of an inch, and that the centrals, measuring from distal to distal surfaces have separated at least one-sixteenth of an inch. How can this be accounted for since the appliance did not touch any teeth anterior to the bicuspids? I can only account for it by the supposition that the two halves of the superior maxilla have separated in the median line. If the casts be examined a depression will be plainly seen in the gum above the space between the central incisors, while there is no depression in the corresponding position in the first cast.

"I have quoted thus freely on account of an opinion often expressed and formerly firmly believed by myself that a separation would be much more likely to take place in the line of the suture between the intermaxillary bone and the superior maxilla of either side. The fact that congenital fissure of the hard palate extends from the soft palate in the median line as far as the intermaxillary bone, then deviates to the right or left or follows both directions in the line of the suture between the intermaxillary and superior maxillary bones would lead us to expect any separation of the superior maxillæ in the same lines.

"Appliances for Spreading the Arch.—The combination which I used for spreading the arch has worked so well in this and many other cases, that I think a description will not come amiss.

"You will notice that I call it a 'combination' and at first sight its general features will seem so familiar that you will say that it is nothing new. Its various parts are old, but the exact combination new. I use the *Magill* bands, with *Angle's* tubes soldered to the buccal surfaces of two of them. Instead of soldering a tube to the lingual surface of each band, and extending a wire through the two tubes as recommended by *Dr. Angle,* I solder a flat bar about an eighth of an inch wide or less, and thick as number 24 plate U. S. G. to the lingual surfaces of the bands on each side, thus uniting the band of the bicuspid to that of the molar, or the band of the cuspid to that of a second bicuspid. In this bar are punched holes at short intervals. In opposite holes, across the arch, are placed the ends of an *Angle* jackscrew, or a *Talbot* spring. I prefer the spring because it can be bent to lie almost in contact with the arch of the palate, and be out of the way

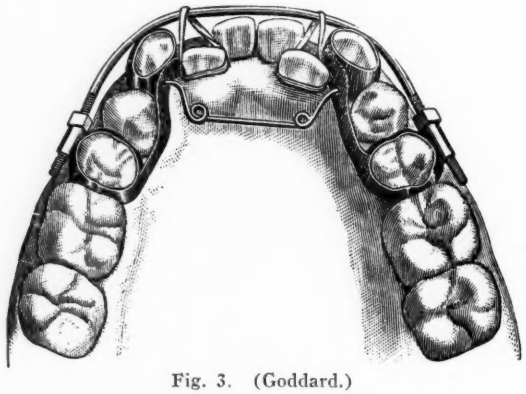

Fig. 3. (Goddard.)

of the tongue much more than the jackscrew. The spring or jackscrew can be placed in any position along the bar, whenever the force is needed, and will stay in place, not sliding forward or backward, the ends being retained in the holes. If necessary, two springs or two jackscrews can be used, one at each end of the bars, but I have found one to be sufficient. The bar is easily soldered to the bands as follows: Fit the bands on the teeth or on the cast, as preferred, melt a little solder on the lingual surface of each band, place the bands on the teeth of the cast, which is better for the purpose if made of equal parts of plaster or marble dust or sand, although plaster alone will answer the purpose. Having fitted the bar and punched the holes in it with a plate punch, tip the cast so the bar will lie in place and apply the blowpipe flame. The bar, being free, will be heated first, and the solder already on the bands will easily unite with it, without heating the whole cast to a high heat.

"If it is desired to move four teeth on each side; viz., two cuspids, bicuspids and molar, the bands may be placed on the cuspid and second bicuspid on each side and the bar extended beyond the second bicuspid along the molar, or the bands may be placed on the first bicuspid and molar on each side and the bar extended forward around the cuspid, in which case the end of the bar should be made narrower and extend slightly between the cuspid and the lateral incisor.

If it merely rests on the inclined surface of the cuspid as force is applied, it may move along this inclined plane and force the bicuspids slightly out of their sockets, or the cuspid into its socket without moving it out as desired.

"After the arch has been spread a bowspring of wire can be placed around the anterior teeth and held in place by inserting the end in the tubes on the buccal surfaces of two bands (Fig. 3). This bowspring can be used for attaching rubber bands for drawing incisors forward or rotating them. To prevent the ends sliding too far through the tubes, a bayonet may be bent in each end of the bowspring, or the ends may be threaded and nuts put on to keep it in place. If the latter plan is followed, the size of the bowspring may be increased or diminished by moving the bowspring backward or forward. If it is desired to move several incisors forward at once, the bow may be ligated firmly to these teeth and moved forward by turning the nuts at the ends. If the case is a V-shaped arch, the prominence may be reduucueud by first spreading the arch, then inserting the bowspring, putting the nuts behind the tubes. By turning these nuts the bow may be drawn back and thus move the incisors with it.

"The arch may be retained after spreading by substituting a V-shaped wire for the Talbot spring, or if the bowspring be used outside it may be stiff enough to keep the arch spread.

"An inner bow may be used to advantage for keeping the arch spread and reducing V-shaped or prominent incisors, by extending rubber bands from it to the offending teeth. This appliance may be made of German silver, but I prefer platinum for the bands, clasp gold for the bar and bowspring and gold plate for the tube.

"*Movement of the Teeth.*—There is a question which needs our attention and which I would very much like to hear discussed, that is: What changes take place in the surrounding tissues when teeth are moved? The common answer is: 'Absorption of tissues in front of the moving teeth and building up behind.' This answer has not fully satisfied me, for in many cases where several teeth are moved at once and in the same direction, I have observed a movement of the alveolar process itself. I noticed this first in 1883, and have taught it to my class ever since. I saw no notice of it in print before that time, and have seen it mentioned but twice since.

"In the first volume of *Dr. Farrar's* book on irregularities, page 142, he speaks of this movement as a 'bending of the alveolar tissue.' The term is a good one, and I am surprised that such a bending or movement is not more widely recognized. It was first brought to my attention in a case in which I was retracting incisors by means of rubber bands attached to a plate in the roof of the mouth, which plate was clasped to the molars. After a few weeks, as the incisors moved in, I noticed that the plate did not fit the roof of the mouth as before, and upon examination found the palatine portion of the alveolar ridge, posterior to the incisors, much fuller than before, so much so as to prevent the plate going back to its former position.

"I have noticed the same bending of the ridges when the four (4) incisors were moved outward, and in cases of spreading the arch, yet I have never known or heard of such a result. The outer plate of the process at least must move with the teeth. We might in that case expect to find the ridge much thicker after the

teeth are moved, from filling up the sockets behind the teeth, but such is rarely the case. When the arch is spread there is more room in the roof of the mouth. The whole ridge has moved or been bent on its base as if the process were semi-plastic. When prominent incisors are reduced, if the ridge did not bend we would expect the teeth to move without removing the prominence of the labial portion of the gums and ridge, we would expect the ridge to remain prominent till sufficient absorption had taken place to reduce it to a normal thickness. Yet as the incisors are moved, you will find the gums and ridge over their roots no thicker at one time than at another, and when the teeth have reached their new location the outer plate of the process will be found to have arrived at the same time.

"When single teeth are moved along the ridge or outward or inward, there is without doubt an absorption in front and building up behind, as well as a compression of the cells of the process, but when several teeth are moved in one direction I have no doubt that there is, as *Dr. Farrar* expressed it a 'bending of the alveolar tissue.'

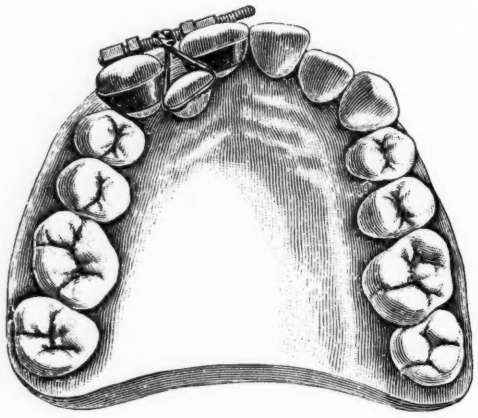

Fig. 4. (Angle.)

"Making Room for an Inlocked Incisor.—I have found an easy and simple way of making room and moving forward an incisor. A few years ago *Dr. Matteson* gave a method, as illustrated in the *Dental Cosmos,* by placing a spring in front of the overlapping teeth and attaching a thread or narrow platinum band to the two (2) ends of the spring in such a manner that it passed the teeth on which the spring rested and behind the inlocked tooth. By the tension of the spring this thread or thin band, tending to straighten, would push apart the overlapping teeth and move forward the inlocked ones. While the appliance seemed simple and very efficient in theory, I found in practice that it did not work so well. The thread or band would slip up or down and infringe on the gum, or slide off the cutting edge of the tooth. It was difficult to keep it in place. Even when it kept in place it would spread the overlapping teeth too far apart before the inlocked tooth could move forward in position. I found the same trouble with *Dr. Farrar's* appliance, in which a similar platinum band was used, and the ends of it attached to a screw for straightening it.

"I was not wholly satisfied with this appliance because the teeth on one side tended to return when the straight wire was substituted for the spring.

I therefore substituted a cut wire for the spring, placing two (2) nuts on it. (See Fig. 4.) These nuts can be placed next the tubes on each side, and as they are turned will force the teeth apart, while a rubber band extended from the screw over the offending tooth will draw it forward (Fig. 4). This rubber band may well be applied as soon as lateral movement is begun with the overlapping teeth, that is, as soon as any room is gained. An additional advantage of this plan is that the rubber binds the teeth together, so as to prevent the side teeth from being crowded out of the line of the arch. If the irregularity mentioned is on one side only, the line between the centrals will not usually correspond to the median line of the face but by means of such an appliance as described, force is exerted so as to move the teeth towards the median line so that the two (2) will correspond.

"*Instruction in Orthodontia.*—The teaching of orthodontia in colleges has become of great importance in the last few years. It should be taught practically as well as didactically. I have found the following a good plan, and it is the gradual result of eleven (11) years teaching:

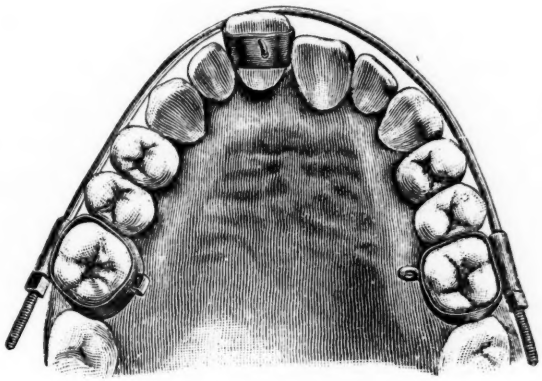

Fig. 5. (Goddard.)

"Instruction is begun in the junior year and continued through the senior year. The didactic instruction consists of lectures and quizzes illustrated by means of drawings, the blackboard and the lantern. By means of an opaque attachment casts and appliances can be projected on the screen as transparent slides. Cuts from books and journals can also be thrown on the screen by the same lantern. They are easily arranged and add very much to our means of illustration. Junior students are required to devote at least one hour a week to making appliances. Each student is required to provide files, pliers, draw plate, screw plate, etc. He is furnished with large German silver wire and heavy plate. He is required to draw the wire down to the various sizes needed and to roll the plate out to various numbers needed; to cut screw threads and wire, make nuts, taps, draw tubing, and construct various characteristic appliances, such as *Magill* bands, jack and drag screws, *Talbot* springs, appliances for rotating, retracting, spreading, etc. A list of these requirements is given to each student and he is required to work under the instruction of a competent demonstrator of orthodontia technic.

"The senior students are required to work practical cases, which the infirmary has provided in great numbers. A patient is assigned to each student,

or if there are not enough for that, one case is assigned to two (2) students who work together and each receives as much benefit as though he had a case alone. He is first required to take impressions for casts and to fill out the following blank:

UNIVERSITY OF CALIFORNIA—COLLEGE OF DENTISTRY
Orthodontia for Seniors

Name of Operator ..... No.....
Name of Patient .....189.....
Sex of Patient ..... Age ..... Nativity .....
Nativity of Father ..... Nativity of Mother .....
Regularity of Father's teeth .....
Regularity of Mother's teeth .....
Habits. (A) Mouth Breathing .....
(B) Thumb Sucking .....
(C) Lip Sucking .....
Enlarged tonsils .....
Median line .....
Occlusion, Normal, Prognathous, or Sup. Protrusion .....
Mastication .....
1. No. of teeth out of normal line .....
2. No. of teeth within normal line .....
3. No. of teeth rotated .....
4. No. of teeth long or short .....
V-Shaped arch .....
Width of arch between first molars ..... inches
Height of Palate ..... High ..... Medium ..... Low. .....
No. of teeth decayed .....
Structure of teeth, ... Hard ..... Medium ..... Soft .....
General description of case .....
Drawing .....
Treatment .....
Result .....

"Clinical lectures are then delivered over these cases. The patient is seated in an operating chair near a blackboard. The student, or students, in charge have the blank and cast ready for inspection. While the class is examining the patient, a drawing is made on the board representing the irregularity. The case is then described and attention called to its peculiarities, and the treatment prescribed. The proposed appliance is drawn on the board with colored chalk, and its action explained.

"The student is instructed to make such appliance, and bring the patient to the next clinic, with the appliance in position. Having already made appliances in his junior year he is competent to make whatever is prescribed. These clinics are held once a week, and several patients can be examined at each. The students are required to present the patient at these clinics at frequent intervals, so that progress may be noted, mistakes prevented or corrected, etc.

"For similar cases different appliances are prescribed, in order that the efficiency may be tested, and the students thus have an opportunity of serving their workings. Thus, the screw is used in one case for spreading the arch, and the spring in another. On one side of the mouth a drag screw is used for retracting the cuspid and on the other elastic bands, etc., etc.

"When a case is complete, retaining appliances are inserted, and the patient instructed to be present at intervals for inspection.

"Casts are required of each case, showing the beginning and end of the case, and any instructive intermediate stages. These casts, with the regulating appliances in position, are stored in the museum, for reference and future use in illustrating lectures and clinics.

"These clinics have proved very interesting and instructive to all concerned, and the students have, as a rule, eagerly availed themselves of the opportunities presented, often bringing patients for the purpose. When cleft palate cases can be obtained they are shown at the clinic and appliances constructed for their relief.

Fig. 6.

Fig. 7. (Goddard.)

In the *Items of Interest,* 1897, page 119, Goddard states the following propositions:

"*Proposition* 1.—If the deformity is due principally to the lower jaw, I would first try to jump the bite and force the lower jaw forward with a plate in the upper arch, having an inclined plane posterior to the superior incisors on which the inferior incisors could occlude, as shown by *Dr. Kingsley* in *Oral Deformities.*

"The superior incisors could be drawn slightly backward then, by rubber bands attached to the plate.

"A more effective appliance would consist of metal crowns for the superior molars with lugs projecting down behind the inferior molars, so that the teeth could not be occluded without throwing the lower jaw forward.

"To the buccal surfaces of these crowns I would solder tubes for the in-

sertion of the screw cut ends of a labial bow, the anterior part of which would rest in notches cut in bands cemented to the superior central incisors. By means of nuts behind the tubes, force could be brought on the superior incisors to reduce slightly their protrusion, and close the space between the centrals. This bow should be of stiff gold wire, and wider than the arch, so that the superior bicuspids could be moved buccally by means of rubber bands or ligatures. The bow would bind the superior teeth together so that the strain put on the lugs in jumping the bite would be borne by all the teeth instead of by the molars alone.

"*Proposition* 2.—If the profile of the face indicated that the deformity could be corrected by operating upon the superior arch alone, I would extract the superior first bicuspids and cement on the first molars broad bands with buccal

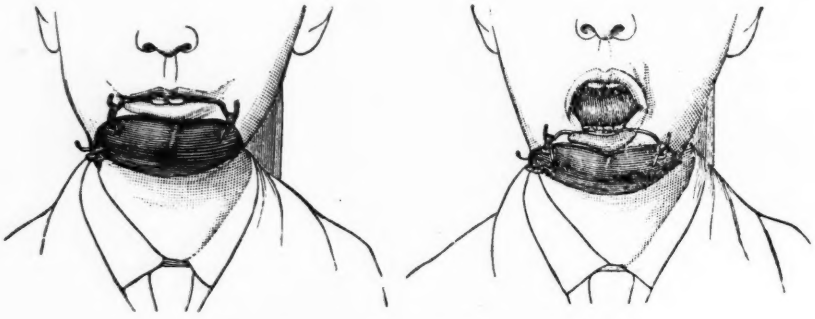

Fig. 8.—Depressing lower incisors. (Goddard.)

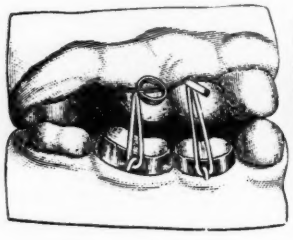

Fig. 9.

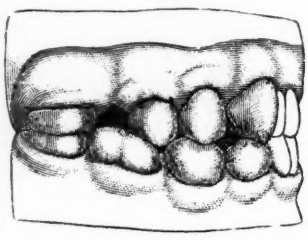

Fig. 10.

tubes, in which I would insert a labial bow, as described above, and shown in Fig. 5.

"Behind these tubes I would apply nuts for tightening the bow. These would be merely for retention, as, in the majority of such cases, the first molar and second bicuspid on each side—four teeth only—would not afford sufficient anchorage for moving the six anterior teeth.

"For moving the anterior teeth, and thus reducing the protrusions, I would use the cap and bit shown in Figs. 6 and 7. The vulcanite bit should be made on a cast formed in an impression taken with the bow in place, so as to fit over it, and should not be allowed to project between the central incisors. The cap and bit could be worn at night only, or at such times as the patient is not at school or at meals. The nuts on the end of the bow should be tightened every morning just enough to take up the slack caused by the movement of the anterior teeth during the night. The rubber cord from the cap to the bit should be so applied as to draw upward as well as backward and force the superior teeth somewhat

into their sockets (see Kingsley, p. 134, Fig. 66). This is to prevent the inferior incisors impinging on the lingual surface of the superior as they move back. If reduction of the length of the superior incisor is not desirable, the inferior might perhaps be forced into their sockets by a bit and chin piece as shown in Fig. 8, or the bit might be opened by means of gold crowns on the inferior molars; the bicuspid could then be forcibly erupted by rubber bands extending to the superior teeth as shown in Figs. 9 and 10."

In the *American Text Book of Operative Dentistry,* first edition 1897, *Dr. Goddard* wrote the chapter on *Orthodontia Exclusively as an Operative Procedure.* He states:

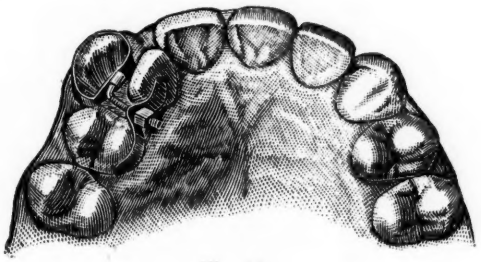

Fig. 11.

Fig. 12.

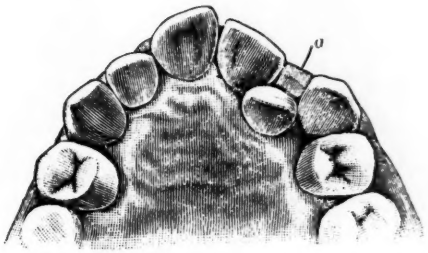

Fig. 14.

Fig. 13.

Fig. 15.

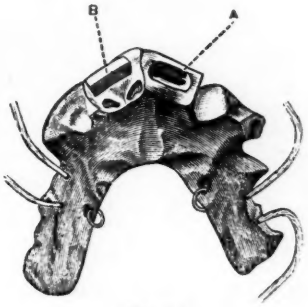

Fig. 16.

"The Normal Arch.—As the study of physiology is necessary before the study of pathology, so is a study of the normal arrangement of the teeth necessary before the treatment of their irregularities should be undertaken.

"The face from the hair to the chin measures three-fourths of the whole height of the head. The forehead to the root of the nose measures one-fourth, the nose one-fourth and the mouth and chin one-fourth. The distance vertically from the root of the nose to its lower border is equal to the distance from this point to the bottom of the chin. Of this latter disance one-half is occupied by

the lips and one-half by the chin. The nose, then, equals in length the lips and chin.

"The Normal Occlusion of the Teeth.—The six upper anterior teeth close over the six lower from a third to a half of the length of the latter. The lower second bicuspid occludes between the cusps of the two upper bicuspids; this is a point easily remembered. Each bicuspid and molar is antagonized by two of the teeth of the opposite jaw. The buccal cusps of the lower teeth close between the buccal and lingual of the upper, and the lingual cusps of the upper close between the lingual and the buccal cusps of the lower.

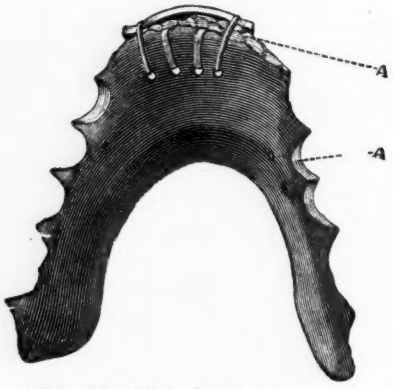

Fig. 17.—Plate with gutta percha extremities.

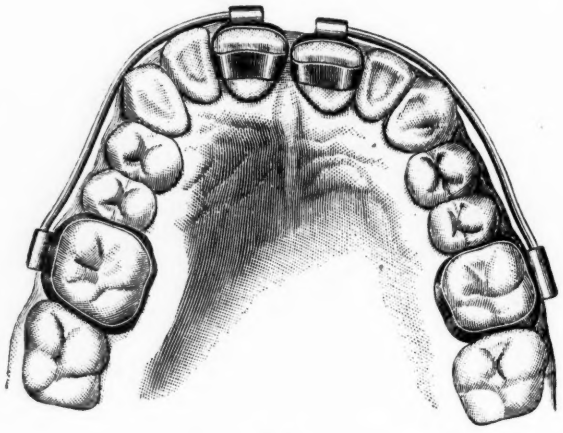

Fig. 18.

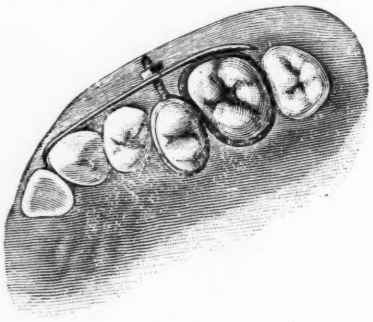

Fig. 19.

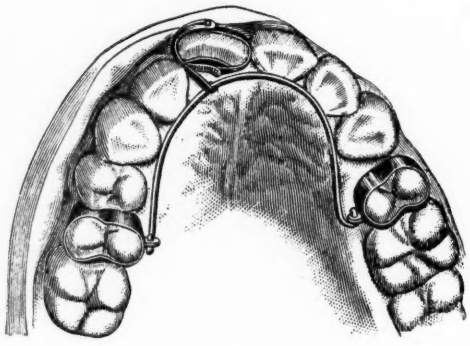

Fig. 20.

"As the lower moves laterally during mastication the cusps of the bicuspids and molars grind upon each other, while the six anterior teeth, overlapping but not touching, pass by each other and escape wear. In order to touch the cutting edges of the upper and lower incisors upon each other the lower jaw is protruded, and at such a time the masticating teeth do not occlude.

"In examining the upper six anterior teeth from the labial aspect it will be seen that they touch each other at one point only, about one-fourth of the distance from the cutting edge to the gum, and that the long axes of the teeth are not parallel but the crowns slant towards the median line. Of the six upper anterior teeth the central incisors are the longest, the laterals next, and the cuspids

shortest, though properly the cuspid is thought to be the longest tooth because of its prominence and the length of its cusps. It will be noticed that the gum line is higher on the cuspid, thus adding to its apparent length.

"A line connecting the cutting edges and cusps of half the upper teeth forms a double curve, highest at the third molar and lowest at the central incisor, the line of beauty, while such a line on the lower teeth forms but one curve, highest at its ends.

"While the aim of the student of orthodontia will be to correct all irregularities, and reduce the abnormal to the normal, it will be possible in many cases to do this only in degree. The normal may always be approached, but not always attained.

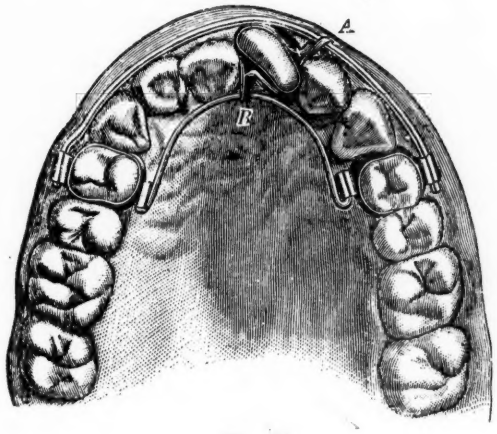

Fig. 21.

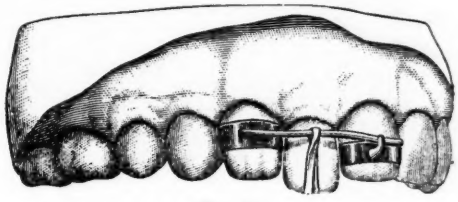

Fig. 22.

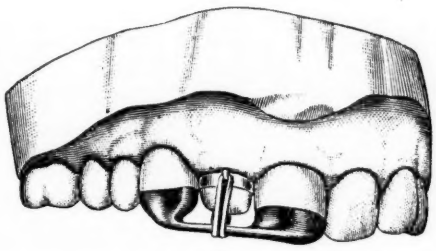

Fig. 23.

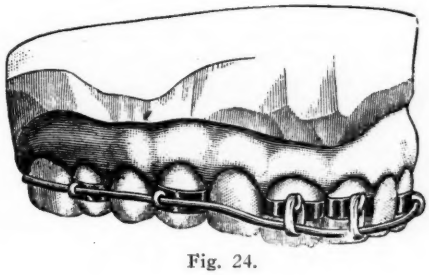

Fig. 24.

"The following *Classification of Irregularities* was suggested in the above book.

Aberrations from the normal arch are almost numberless, but may be grouped into classes as follows:

1. Lingual displacement: a tooth inside the normal arch.
2. Labial displacement: a tooth outside the normal arch.
3. A tooth rotated.
4. A tooth extruded.
5. A tooth partially erupted.
6. Several teeth in any or all of these positions.
7. Prominent cuspids and depressed laterals.

8. Pointed arch. (V-shaped.)
9. Upper Protrusion.
10. Double Protrusion.
11. Constricted arch. (Saddle-shaped.)
12. Lower protrusion, or prognathism.

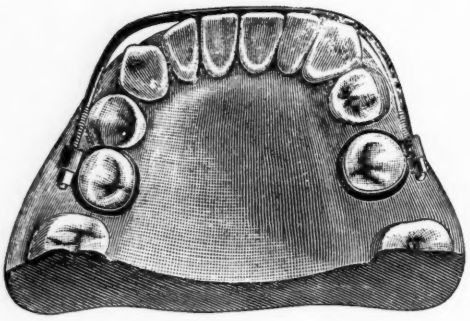

Fig. 25.

Fig. 26.

13. Lack of anterior occlusion.
14. Excessive overbite.
15. Separation in the median line."

Figs. 11 to 26 are taken from *Goddard's* article and will describe themselves.

ABSTRACT OF CURRENT LITERATURE

Covering Such Subjects as

ORTHODONTIA — ORAL SURGERY — SURGICAL ORTHODONTIA — DENTAL RADIOGRAPHY

It is the purpose of this JOURNAL to review so far as possible the most important literature as it appears in English and Foreign periodicals and to present it in abstract form. Authors are requested to send abstracts or reprints of their papers to the publishers.

The Investing Tissues and the Extraction of Teeth. F. D. Lamb. The British Dental Journal, 1920, xli, No. 15, p. 701.

The author points out the desirability of giving attention to the alveolus and gingival tissues following the extraction of teeth, to promote the comfort and repair of the tissues, the correction of deformity, and to facilitate the adaptation of dentures. Under local anesthesia, the alveolar bone can be trimmed by nibbling forceps in a few minutes, hastening substantially the insertion of dentures, facilitating their effective adaptation, controlling the ridge form and to some extent shaping it at will. The prosthetist is well aware that the broad and massive ridge with external undercuts and bony prominences is not the best for his purpose, either for retention or for strength in the denture itself, and appreciates the value of surgical control of the ridge. The lower incisor region is often a source of worry to the prosthetist, due to the forward bending of the alveolus by the slowly inclining teeth, resulting in an unfavorable condition for denture adaptation. If the alveolus is also removed when the teeth are extracted, such trouble should be eliminated. There are edentulous maxillæ to which the premaxillary gum tissue is loose and flabby and inimical to the stability of a denture. The surgical manipulation of the tissue to secure more uniform resistance is suggested. It is a frequent experience to find an upper molar showing extensive gum recession and alveolar absorption both palatally and buccally, and extraction of the tooth leaves an upstanding process centrally placed, over which there is no gum tissue to contract, the result being a painful area, healing of which is delayed. The nibbling forceps should remove the alveolus to a desired level. There are cases in which the application of silkworm gut sutures to lacerated gum tissues is to be recommended.

The Pathological Conditions of the Teeth as Shown by X-ray. H. J. Means. Ohio State Medical Journal, 1920, xvi, No. 3, p. 157.

Dental caries and dental work are the most frequent causes of alveolar abscesses, which are of very common occurrence. It seems to be a conservative estimate that between 40 and 50 per cent of individuals with devitalized

teeth will have one or more abscesses. The danger of alveolar abscesses lies in the insidious mode of onset. The usual course is a slow symptomless development, but the focal infection may be responsible for headaches, earaches and facial neuralgia. The only positive means of diagnosis is the x-ray and the only safe procedure is to examine every large filling, crown or bridge. The importance of good x-ray negatives cannot be overemphasized, and the correct interpretation of negatives requires familiarity with the fundamental principles of dental anatomy and pathology, in addition to a knowledge of ordinary Roentgen diagnosis. The x-ray holds first place in the diagnosis of septic conditions of the mouth. The blind abscesses which give no sign of their presence can be demonstrated in no other way. In chronic abscesses with a discharging sinus and pyorrhea the x-ray will give information as to the size and involvement of surrounding tissues which can be determined in no other manner. A dental x-ray examination is indicated in every case of chronic systemic disturbance or any infection of streptococcic or staphylococcic origin. Practically every disease having its origin from the pus-forming organisms may result from oral sepsis. The most constant organism found in alveolar abscesses is the Streptococcus viridans. The most important way in which infection from oral sepsis spreads is by metastatic infection through the blood and lymph channels; this is greatly facilitated by the peculiar character of alveolar abscesses.

The Relation of Teeth to General Health. Ch. H. Lawrence. Boston Medical and Surgical Journal, 1920, clxxxvii, No. 182, p. 443.

Dental sepsis undoubtedly is the cause of systemic disease in certain instances, and a careful examination of the teeth should therefore always be made, besides questioning the patient as to the pressure of dental symptoms. If the x-ray findings alone are positive, extraction of useful teeth should not be resorted to without due consideration, experience having shown that benefit is obtained in only a small number of cases. Moreover, the extracted tooth is not always as bad as apparently indicated by the x-ray. The fact must be kept in mind that mastication is an important part of digestion, and that disorder of nutrition may arise from lack of teeth. Anemia and disorders of digestion may be due in some cases to dental sepsis; in others, they are as surely caused by too radical extraction in its treatment. From the standpoint of cleanliness, artificial teeth should not be permanently fixed in the mouth. From the medical point of view, permanent bridge work and similar devices are not desirable. The relation of dental conditions to general health, although extensively discussed in the literature, is by no means thoroughly understood. Until more clinical facts are available, caution is recommended in promising results from the extraction of diseased teeth.

Calculus Formation in the Antrum of Highmore. Seidel. Archiv für Ohrenheilkunde, 1919-20, civ, Nos. 3 and 4.

The formation of calculi in the antrum of Highmore is rare. Calculi develop around foreign bodies, or through calcification of malignant or inflam-

matory polypoid new-formation. The pus after an acute or chronic inflammation of the maxillary antrum can also act as a foreign body, in the form of caseous, cholesteatomatous, or pseudocholesteatomatous masses. For the pathogenesis of one such case, the author propounds the theory of a developmental disturbance of the maxillary antrum, with persistance of the myxomatous tissue and subsequent calcification of the same. A later infection causes a tendency to the extrusion of these calculi. It is only through an accurate histologic examination of also the peripheral portions of calculi of the maxillary antrum that reliable information can be obtained as to the mode of origin in a given case.

Thrush in Children and the Biology of the Thrush Fungus. E. Steinert. Zeitschrift für Kinderheilkunde, 1920, xxv, p. 83.

Working in the German Children's Clinic in the Prague Foundling Asylum the author tried, without success, to elucidate the conditions under which the thrush fungus settles in the buccal mucosa. The reasons for the lodging of thrush in young infants are stated by most observers to be the relative rest of the infantile mouth, the dryness of the mucosa as a result of the relatively late establishment of the function of the salivary glands, as well as the acid reaction of the buccal mucosa. However, this does not explain the apparent irregularity in the number and gravity of the infections, especially as these requirements are met with by all infants, whereas, only a part are attacked, the exposure to infection being identical for all. A review of the literature does not answer the question, if the buccal catarrh which is present in children suffering from thrush, is a cause or a result of the thrush-infection, preceding or following it. Another doubtful point is the primary or secondary lodging, or participation, respectively, of the other bacteria of the mouth in the thrush-disease; also it is left an open question if a primary dyspepsia is required for the onset of thrush; finally, if the mere fact that an infant has thrush, permits a conclusion as to an existing disturbance of the intestinal functions. Two types of thrush could be established by the author; in part of the cases, a very consistent layer of thrush develops rather slowly in localities favorable to the lodging of the fungus, the transitional region between the mucosa of the cheeks and the jaws; spreading apparently by continuity and forming scanty or no metastases. At the end of three or four days, this layer becomes detached and disappears, also in the absence of any treatment. A different clinical picture is seen in dyspeptic or in cachectic children. After the buccal mucosa has become remarkably red and dry, with a strongly acid reaction, small white spots make their appearance rather suddenly and simultaneously in the domain of the entire mouth-cavity, at first presenting a distinctly stellate configuration in especially severe cases, later on forming a furry covering of the entire buccal mucosa and surface of the tongue. Thrush-infections originating in this way obstinately resist all local treatment and subside only very gradually, together with the improvement of the general condition. They indicate a grave lowering of the defensive forces of the buccal cavity or of the entire body. Transitional cases have also been

noted and in conjunction with the cultural findings in both types permit the conclusion that the same pathogenic agent enters into consideration in the two varieties of thrush. In twenty-six cases of thrush examined by the author in over one hundred cultures, only one very circumscribed variety of fungus was found, which presented different forms of growth in the various culture-media. Mutual inoculations showed the undoubted identity of the fungi and the great tendency of the parasite to adapt itself to the existing biological conditions of the culture-medium.

Block Anesthesia in Bucco-dental Surgery. J. Bercher. La Revue de Stomatologia, 1920, xxii, No. 5, p. 245.

When a liquid anesthetic agent is placed in contact with a nerve-trunk, the region innervated by this nerve-trunk becomes blocked, as it were, the entire area supplied by it being deprived of susceptibility to pain. The mouth, the teeth, the lower portion of the face receive this sensory supply from the trigeminus, by way of the superior maxillary and inferior maxillary nerves; so that anesthetic blocking in bucco-dental surgery must be directed toward these two nerve-trunks. Hence, their anatomical position and relations must be accurately understood; and this knowledge will permit an anesthetic solution to be placed in contact with the nerve-roots. The technic of these radicular injections is accessible to all operators; the anesthesias thus produced are perfect and devoid of danger. It is desirable for all dental surgeons to become familiar with the technic of these anesthesias and to utilize them frequently, without hesitation, for all the interventions of bucco-dental surgery. The indications for root anesthesias are very numerous, and their method of arresting sensibility should be extensively employed. It is applicable not only in cases of buccal surgery, such as tumors or bony lesions, but also in a large number of cases of dental surgery. Radicular anesthesia is recommended in difficult or multiple extractions, in pulpectomies, scraping or fistulas, and so forth. The author always resorts to radicular anesthesia for the extraction of wisdom teeth. Several nerve-trunks may be anesthetized in the same session, when this is necessary; for example, the two inferior dental nerves were anesthetized by the author for an operation concerning the mandibular symphysis. The anesthesia may be repeated on the day following the first intervention, or the succeeding days. The only contraindication may be found in the general condition of the patient, and more particularly, in a badly compensated heart lesion.

Root anesthesias, when carried out with a rigorous technic, yield perfect and constant results, failures being due solely to errors on the operator's part. The procedure should be frequently utilized, without becoming discouraged by an unsuccessful outcome, rather trying to discover the cause (Testing of solutions, modifications of a defective technic). The author's statistics show only three complete failures, in a considerable number of radicular anesthesias. One case concerned the blocking of the inferior dental nerve, in a soldier who had an old fracture at the angle of the jaw. Undoubtedly, in this instance, the nerve had been torn by the traumatism and had lost its normal

anatomical position, while nerve collaterals had had sufficient time to become established through anastomosis. In the other cases, the superior maxillary nerve was to be anesthetized, and the failure of the injection to produce anesthesia was here in all probability due to the solution having lost its anesthetic properties. With special reference to complications, the author never observed neuralgias or sensory disturbances following upon radicular anesthesias. The patient usually complains of some pain after the intervention, but this can be controlled by 0 gr 50 aspirin, and after a short rest, he will be enabled to resume his operation. Concerning the anesthetic solutions, cocaine and all its derivatives may be utilized for the performance of radicular anesthesias; the author accords the preference to stovaine and novocain. The necessary instruments consist only of a sterilized syringe of 5 c.c. and a fine platinum needle 7 to 8 cm. in length. It goes without saying that these radicular anesthesias must be applied under perfect asepsis and a strict technic. A well placed injection provides an anesthesia lasting from between one-half hour to three hours.

Intermittent Hydro-parotitis Caused by Dental Plates. Jardet. Journal de Médecin et de Chirurgie Pratiques, Paris, 1920, No. 99.

Hydro-parotitis is essentially characterized by a sudden swelling of the parotid gland, in patients wearing hard rubber plates, almost invariably appearing at the time of the first meal, rapidly increasing during the masticatory movements, and reaching a variable degree. The condition is accompanied by local tension and interference with the movements of the jaw, sometimes even by acute pain during the first half-hour, and may be mistaken for mumps, as in a case under the author's observation. Without being serious in itself, this affection distresses the patient on account of its appearance, recurrence, and duration, while the physician may be misled, too, under a wrong diagnosis. The glandular swelling may reach the size of a small orange, it extends in front of the mastoid process, embraces the posterior border of the ascending ramus of the mandible, and spreads over the external aspect of the masseter, as far as the posterior border of the buccinator. The distention of the gland is spherical and entirely independent of the skin, which is tense, but of a normal color. The onset of the trouble is usually during the first week that a denture is worn, but it may appear later, as the result of chewing hard, or irritating food, such as nuts, or in consequence of the penetration of hard granules, bits of bones, and so forth, between the gums and the plate. The hydro-parotitis rarely manifests itself on the day of the excoriation, but follows two or three days later, the inflammation of the tissues requiring a certain time to become propagated as far as the meatus of Steno's duct. From now on the condition develops very rapidly, within some minutes, whereas, its subsidence requires a much longer time. The swelling may persist during entire days, but usually tends to disappear more or less completely in the afternoon, returning on the next five or six days, or longer; after this time it ceases, only to return at the end of a month or six weeks, in connection with a cold, or congestion of the buccal mucosa through irritative foods, and kindred causes. The attacks may thus recur during many months until the mucosa has

become completely accustomed to the plate. In the interval of the acute disturbances, there remains a certain induration, sometimes even a slight swelling of the diseased gland. A cure can always be obtained through the omission of the prosthetic apparatus in the first place, and its careful readjustment, combined with a few irrigations with potassium chlorate. Aside from the cases due to dental plates, hydro-parotitis has also been known to follow the employment of iodine or cauterization of the cheeks and is sometimes associated with a bad condition of the teeth and gums.

Dental Infection. Sinclair Tousey. New York Medical Journal, 1920, cxii, No. 11, p. 353.

The author emphasizes the fact that a great variety of symptoms are known to have dental infection as their frequent, common, or even usual cause. These symptoms are as manifold as the different organs to which the blood carries the poison from a dental abscess, and include high blood pressure with a tendency to result in arteriosclerosis, neuritis, neuralgia, and also various eye troubles; indigestion, ulcer and cancer of the stomach, cancer of the gall-bladder, etc. Skin diseases and insanity are in many cases due to dental infection. Many of the different diseases and symptoms, if taken in time, have been shown to be curable by the eradication of the focus of infection. It is noteworthy that pathogenic germs are often found in the vital pulps of teeth affected by pyorrhea or having carious cavities. The x-ray has often demonstrated extension of pyorrhea from an infected retained root as the cause of destruction of the alveolar process of a neighboring tooth. It has long been known to the author that a vital tooth may show periapical infection and he has made a radiographic diagnosis of pariapical infection in teeth which were vital, some with and some without pain. The most difficult cases to decide about for the dentist are the cases of a vital pulp without pain or swelling, but with unmistakable x-ray evidence of periapical abscess. An infected root canal and an infected periapical space causing systemic infection do not necessarily involve any marked change in the gross appearance of the extracted tooth. The putrescent pulp of a tooth may poison the system through the apical foramen without any necessary change in the gross appearance of the root. The gravity of a given dental infection is sometimes shown by the severe reaction following upon extraction of the tooth, or opening of the abscess through the root canal. It is therefore advisable not to treat more than one or two foci at the same time.

Plastic Operations for Total Defects of the Chin. Th. Voeckler. Deutsche Zeitschrift fur Chirurgie, 1920, cliv, p. 145.

The correction of total defects of the chin is practicable in two ways by means of genuine double skin-flaps, either by the chest-arm method, as originally employed by the author, or by the chest-wall flap method. The latter meets all requirements so completely that the first, more complicated and inconvenient method, should now be entirely abandoned. The chest-wall flap method is not only a complete double skin method, but it also provides more material, espe-

cially for the covering of the soft parts of the lower chin, which are often extensively destroyed in these cases. A long rectangular flap, having the width of the defect is excised, with its base in front of the clavicle. The flap is turned back at its end, for the purpose of double skin covering, and the cutaneous margins are fixed together through fine silk sutures. In order to guard against necrosis of the flap, the excision in its definite length is performed in several sessions, at intervals of about eight days. The last addition to the flap is invariably made in the same session in which the implantation takes place, so as to provide a sufficient nutrition of the flap by its immediate transference into healthy tissue with a good blood-supply. The graft is left connected to the chest at its base and is sutured into the defect. At the end of three weeks, the base of the flap is divided, leaving a longer or shorter segment, according to requirements in a given case. It is a decided advantage of this method that enough material directly connected with the graft is always obtainable for the covering of defects reaching far down toward the neck. A series of cases were successfully operated upon, in which the missing soft parts of the chin were thus replaced by a flap taken from the chest and turned back at its free border.

Surgical Treatment of Defects and Pseudarthroses of the Lower Jaw. R. Eden. Sammlung Klinischer Vortrage, 1920, No. 773.

The experiences furnished by the World-war in the treatment of maxillary pseudarthroses and defects of the jaw are so numerous and variegated that at this time a definite verdict seems possible concerning the different procedures and their application. The development of mandibular surgery has been essentially influenced by Lexer and his clinics, the author being enabled to report sixty cases operated upon in part by Lexer and in part by himself. Upon the basis of their joined experience, bony suture with wires is rejected, as is also the implantation of foreign bodies as substitutes for the defect. The only substitute entering into consideration is the autoplastic periosteum and bone graft. Local anesthesia is sufficient for the exposure and preparation of the maxillary stumps and for the removal of the graft. Lexer was the first to describe the formation of two periosteum pockets at the ends of the defect, into which the graft can be fitted without requiring a special attachment. On account of the latent infection, especially after gun-shot injuries, suppuration cannot always be avoided, but it can be controlled without loss of the graft, provided timely and sufficient drainage is instituted. In certain cases presenting special technical difficulties, the entire middle segment of the mandible has been reconstructed, or a new skin has been built from a graft taken from the tibia. In other cases, the ascending ramus, together with the articular end, has been replaced by a segment of rib, its rounded cartilaginous portion serving as the articular capitellum.

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EDITORIALS

The Responsibility of the Exodontist in Relation to Orthodontics and the Public

AS DENTISTRY develops a greater tendency to divide into specialties, it necessarily follows that the men engaged in the various specialties assume a different relation to the public than does the general practitioner. Of course, the general dentist has a great responsibility in his duty to the public, but the manner of fulfilling it is slightly different from that of the specialist. The family dentist has only to satisfy himself and his patient by the exercise of his best judgment. We are willing to admit that the judgment of a man or the execution of that judgment may be faulty, but if he has done his work to the best of his knowledge, he cannot be held as having failed entirely. The man who errs through lack of proper knowledge cannot be held as liable as the man who possesses the required knowledge and still does what he

knows to be wrong, regardless of his reason for so doing. We know of several instances in which exodontists have been requested by general practitioners to do something that they (the exodontists) knew should not be done. This proves that the responsibility of the exodontist to the public is often greater than is generally recognized.

A specialist is supposed to be an expert in the branch of work in which he is engaged. While preparing for his specialty, he becomes the possessor of considerable knowledge of correlated subjects, and while this may not enable him to do his own work any better, it certainly points out to him the bearing his work may have upon other branches of dentistry, and it influences him to look out for the future welfare of the patient. Our attention has been called to the relation of the exodontist to the public by several things that have recently occurred.

When exodontists are considered, they must be divided into two groups. We are going to admit without any argument that all exodontists exist for the purpose of extracting teeth, but we find one class of these specialists existing *only* for the purpose of extracting teeth at so much per tooth. These men lose all interest in the patient's future welfare as soon as the tooth is out. They who are only interested in exodontia from the purely monetary standpoint do not admit that they owe anything to the profession or the public save the extraction of the tooth marked on a card or desired extracted by the patient, regardless of what other branches of dentistry may think of the future demands for the tooth as a part of the dental apparatus. These men extract teeth because some one has referred the patient to them, then they try to switch the responsibility to the dentist, even when their knowledge as a specialist indicates that the tooth should not be extracted. These exodontists justify themselves by saying that they must get their business from the medical and dental professions and therefore cannot afford to take the chance of giving the patient the benefit of their wide experience by suggesting anything that the general practitioner has not ordered. Specialists who shirk responsibility like this are a greater detriment to the profession than those who err because of lack of knowledge.

Fortunately there exists another group of exodontists who are working for the professional advancement of their specialty by placing the interests of the dental profession and the public above the mere gaining of wealth. There is no question in our minds but that the second man will eventually outstrip the first, even in the gathering of wealth, and will occupy a better social position in the community because he has given his best. We believe there are enough men in the dental profession sufficiently interested in the welfare of the public to refer business to the ethical exodontists, so that these specialists can serve the public as it should be served, without sacrificing their better judgment. The slogan of a certain club is "He serves most who serves best," and this applies particularly to the specialty of exodontia and the man who puts the interests of the public foremost.

Many times an exodontist is placed in an embarrassing position when he is requested to extract a pulpless tooth, as this is more or less a disputed point, and it is probably the most diplomatic thing to follow the advice of

the dentist who referred the patient, even though everything else would indicate that the tooth should be retained. It may happen that the opinion of the exodontist will not agree with that of the dentist, but as both will probably have reasons for their beliefs, and as the patient has placed himself in the hands of the dentist, the responsibility for the extraction of the tooth is really a question for the patient and the dentist to decide. However, in some branches of dentistry we find that there have been certain fundamental facts established which are accepted by all as being the basis for procedure in certain cases. We refer to the responsibility of the exodontist in relation to orthodontics.

The relation of the exodontist to those patients who require or may require orthodontic treatment at a later date is one that needs careful consideration. A patient is referred to the exodontist by the dentist, the exodontist performs the service, and several years later when the patient desires orthodontic treatment, the orthodontist finds that the exodontist did just what should not have been done.

There are men in the dental profession who pay no particular attention to orthodontia, neither do they take time to inform their patients of the necessity for orthodontic work or the benefits to be derived therefrom. As a result of this lack of interest in orthodontia, we find a number of men still extracting teeth for the correction of malocclusion. This includes the extraction of laterals, canines, and first molars, and is advised for children eight and nine years of age! The majority of exodontists know that such treatment as the extraction of anterior teeth for the correction of malocclusions is wrong and little less than criminal malpractice; therefore the exodontist immediately is given a responsibility, which may not be particularly to his liking, but which, we are glad to say, a few of them have assumed in spite of the unpleasant factors that have arisen therefrom. The exodontist who refuses to extract permanent teeth because some dentist has advised it is rendering the patient a great service, but he is also incurring the ill will of the dentist whose advice he opposes. The advisability of the extraction of first molars when they are badly decayed and pulpless may present disputed points; however, the laws of occlusion are so well recognized that there are cases in which we can positively say that first molars that are not diseased should not be extracted. Some men are advocating the removal of all four first permanent molars for the correction of bunching of the anterior teeth. We have yet to see a case of crowded anterior teeth that would ever be benefited by the extraction of the first permanent molars. Some also advocate the extraction of first permanent molars if they possess a slight cavity, justifying the extraction by saying that the pulp may die at a future date and give trouble, and they also extract the remaining molar on the other side to produce harmony in the size of the arch.

Our attention was recently called to a case in which a dentist sent a patient to an exodontist to have the first permanent molars extracted to relieve bunching of the anterior teeth; only one of the first molars was decayed at all and the cavity did not involve the pulp. The exodontist possessed some knowldege of orthodontics and told the patient that there must

be some mistake. Being unable to get in touch with the dentist over the telephone that day, the exodontist did not extract the permanent molars but removed some badly decayed and abscessed deciduous teeth, which the dentist had not ordered extracted. Later, the dentist became very abusive to the exodontist and informed him that when a patient was referred for extraction, it was not the exodontist's business to use his own judgment, but to do what he was told to do. There are a great many dentists who hold a similar opinion, even when they advise something that the majority of the profession know to be wrong. The exodontist wishing to do the best thing for the patient has a responsibility forced upon him which is not very pleasant if he wishes to keep the good will of the dentist.

The responsibility of the exodontist to the public is a factor that has not been recognized by the dental profession, or the exodontists as it should be, and it will have to be given more consideration in the future if exodontists are to render a real service to the public. Recognized standard methods of procedure must be adhered to regardless of the wish of the dentist who has referred the patient for some service (like the extraction of a normal anterior tooth) which should not be rendered. The possibility of orthodontic treatment extends over a considerable period of a patient's life, and malocclusions can be started through minor errors. These are things that the exodontist should remember before he does irreparable injury.

Exodontia is more closely related to orthodontics from the standpoint of the welfare of the patient than some might imagine. It should always be remembered that the extraction of teeth has a great bearing on the patient from an orthodontic point of view. The best thing for the patient should always be the ideal of the dental profession.

Erratum

In the November, 1920, issue of the Journal, the article by Dr. M. N. Federspiel entitled "A Report of a Case of Ostitis of the Mandible with an External Fistula Caused by a Suppurative, Proliferative Pericementitis of a Lower Right Third Molar" should have appeared under the Department of Oral Surgery and Surgical Orthodontia, instead of the Department of Dental and Oral Radiography.

ORTHODONTIC NEWS AND NOTES

The editors desire to make this department a permanent feature of the Journal, but in order to do so must have the full support of the orthodontic profession throughout the country. We would deem it a great favor if our subscribers and readers would send in such announcements as might be of interest to the profession.

Annual Meeting of the American Institute of Dental Teachers

The next annual meeting of the American Institute of Dental Teachers will be held at the Claypool Hotel, Indianapolis, Ind., January 24th, 25th and 26th, 1921.

The program will contain much of interest in dental teaching methods and dental educational affairs. A cordial invitation is extended to all ethical practitioners and others interested along these lines to attend the sessions.

Dr. Arthur D. Black, President.
Dr. Abram Hoffman, Secretary,
381 Linwood Ave., Buffalo, N. Y.

Meeting of the American Society of Orthodontists

The next meeting of the American Society of Orthodontists will be held at the Ambassador Hotel in Atlantic City on May 4, 5, 6, and 7, 1921. An invitation is extended to all who are interested in orthodontia.

J. Lowe Young, D.D.S., President.
Ralph Waldron, D.D.S., Sec.-Treas.

Alpha Omega Dental Fraternity

The Alpha Omega Dental Fraternity will meet in convention on December 26, 27, and 28, 1920, at Baltimore, Md. For full information address the Supreme Scribe, Dr. S. H. Bomenblit, 2459 N. 16th St., Philadelphia, Pa.

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[1]Billings, J. S.: Our Medical Literature, Trans. VII Intern. Med. Congress, Lond., 1881, i, 54-70.

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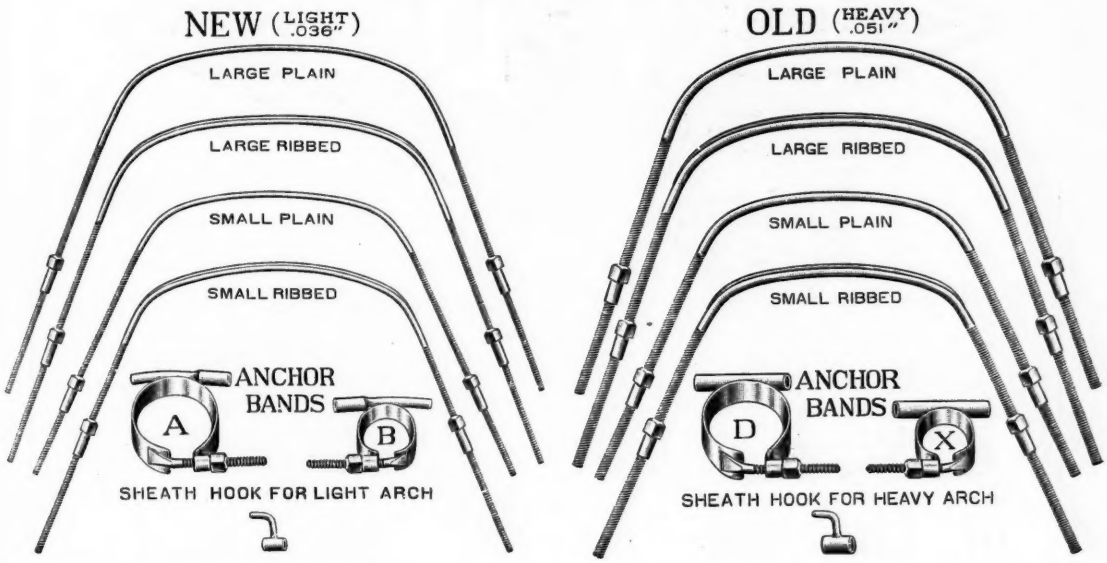

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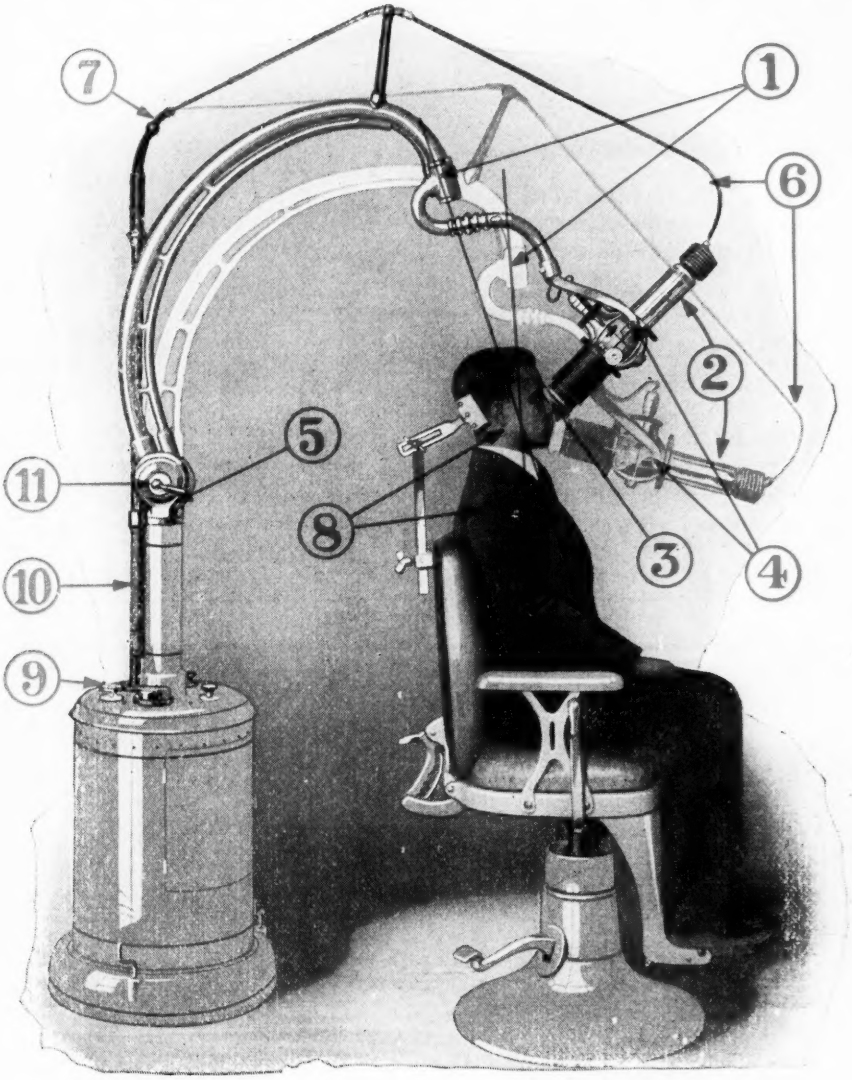

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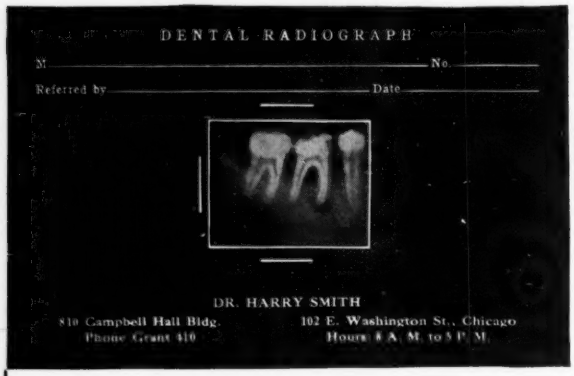

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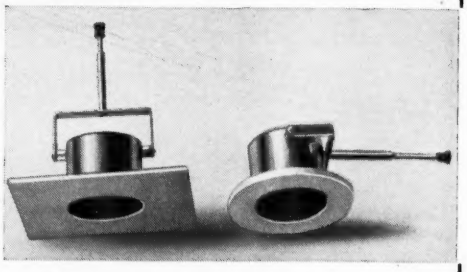

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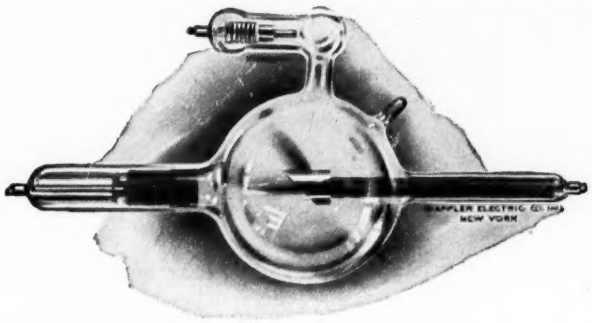

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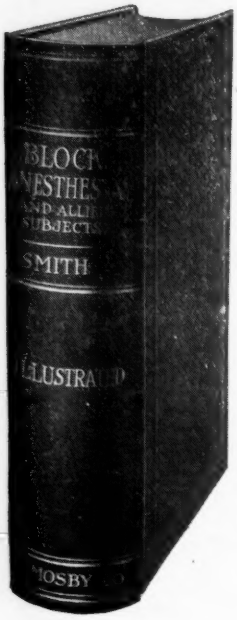

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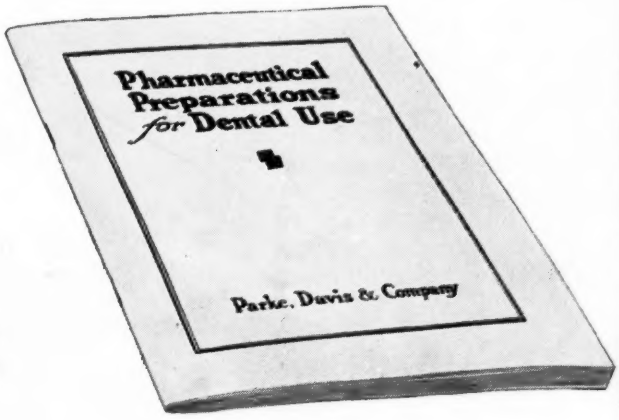

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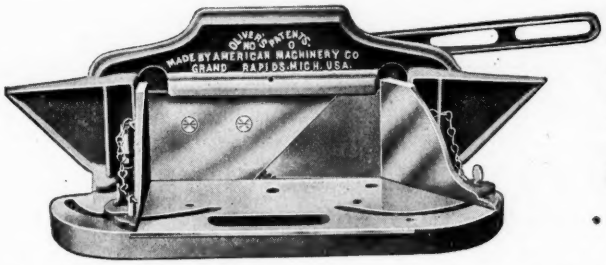

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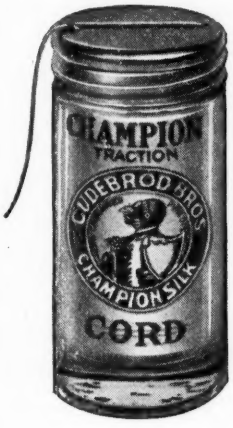

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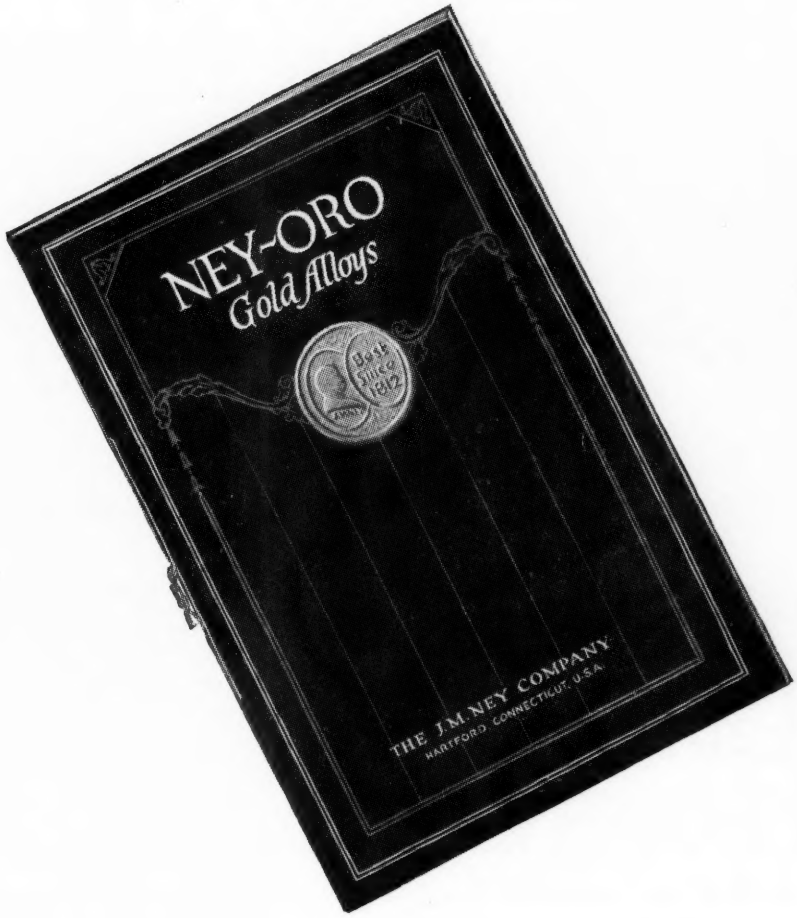

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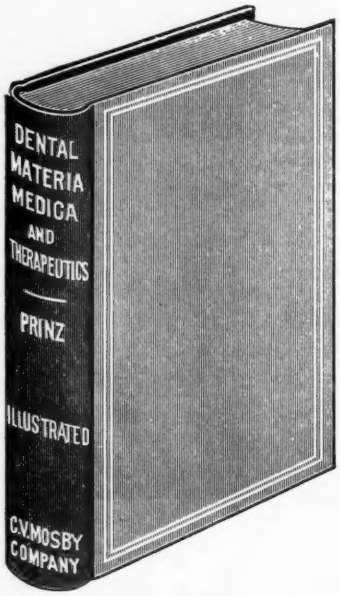

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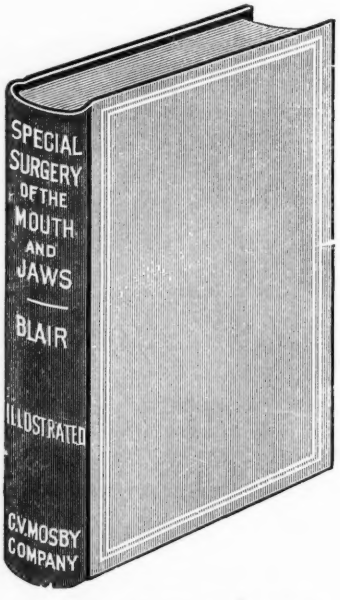

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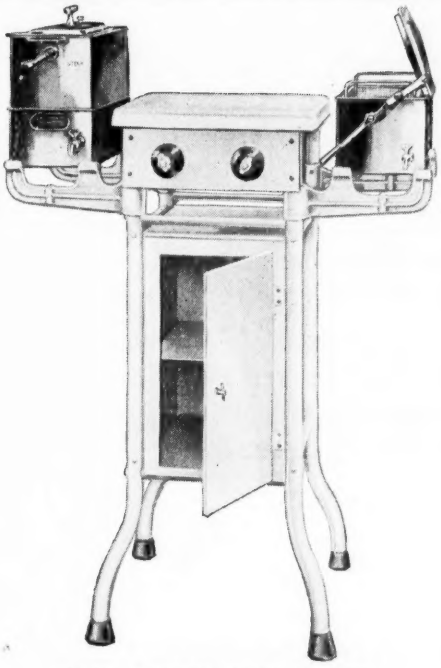

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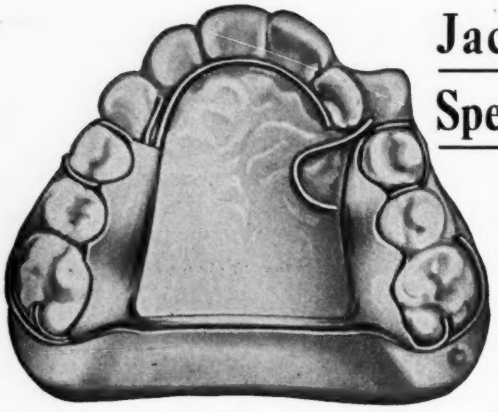

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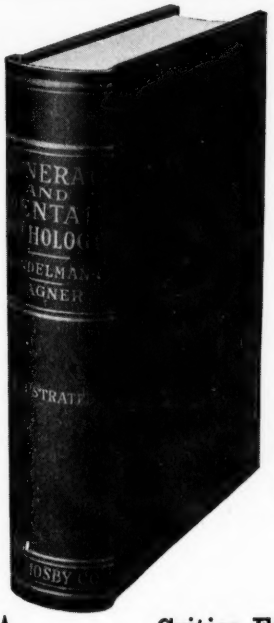

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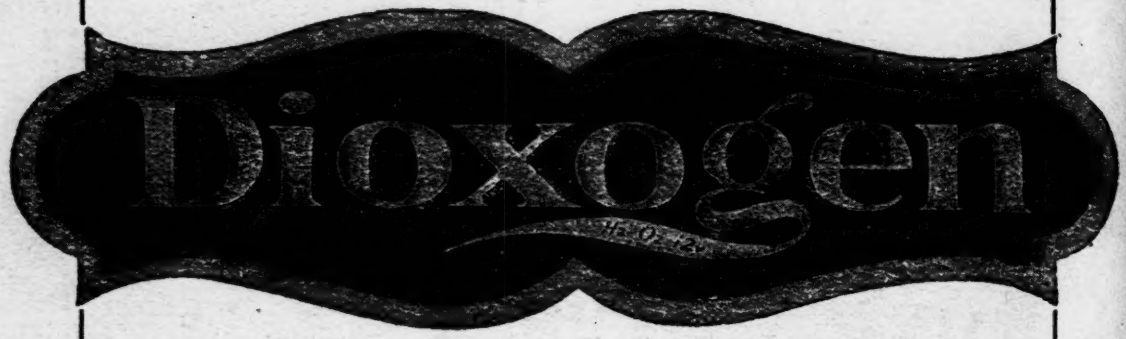

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